VOLUME XXIII NUMBER FOUR

THE NATIONAL GEOGRAPHIC MAGAZINE

APRIL, 1912

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National Geographic Society Researches

With Illustrations

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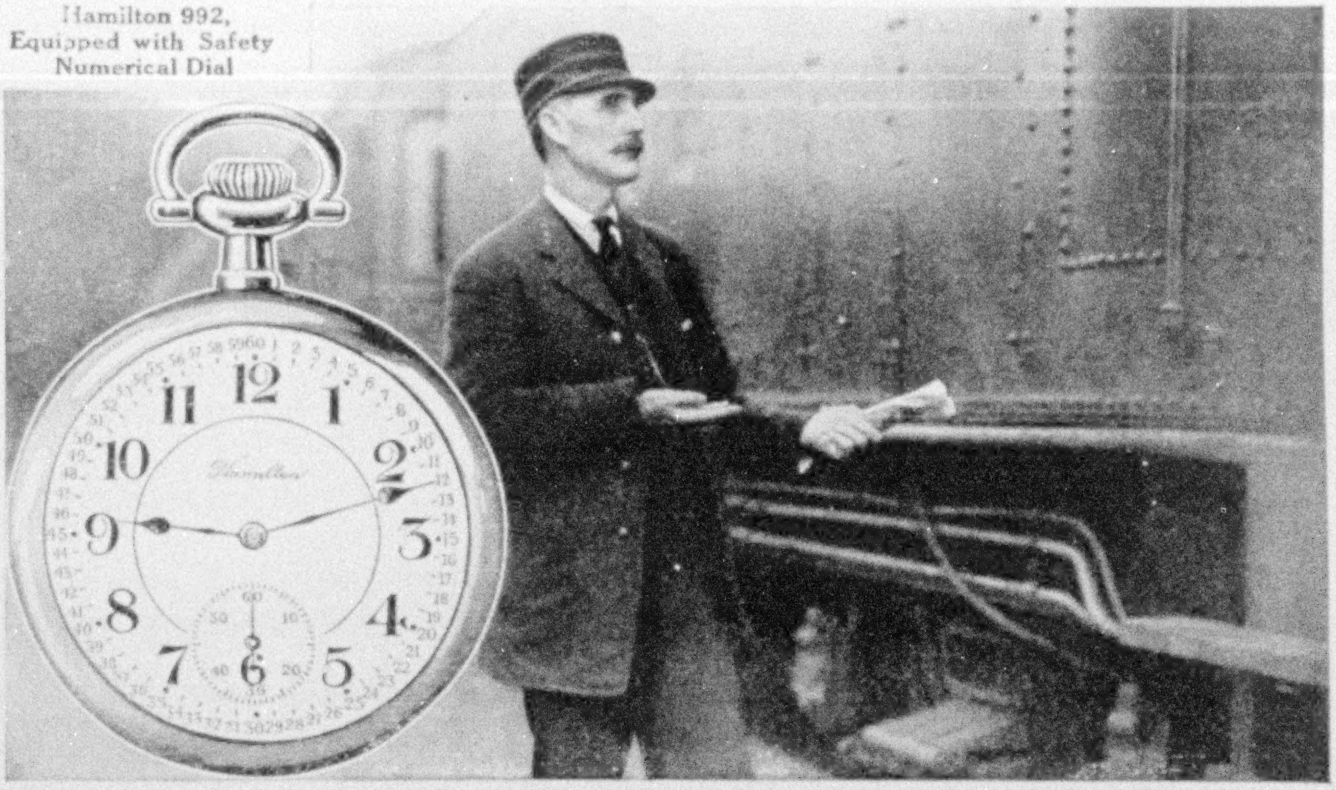

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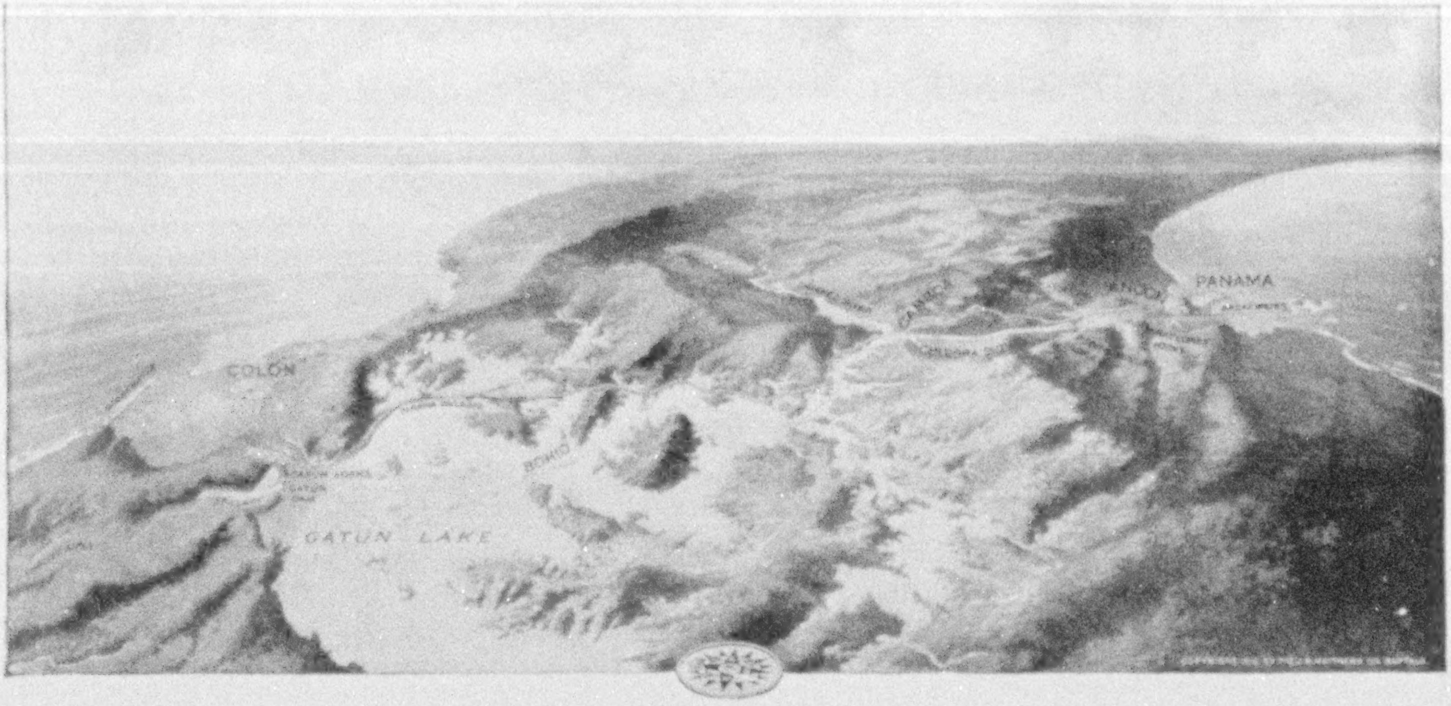

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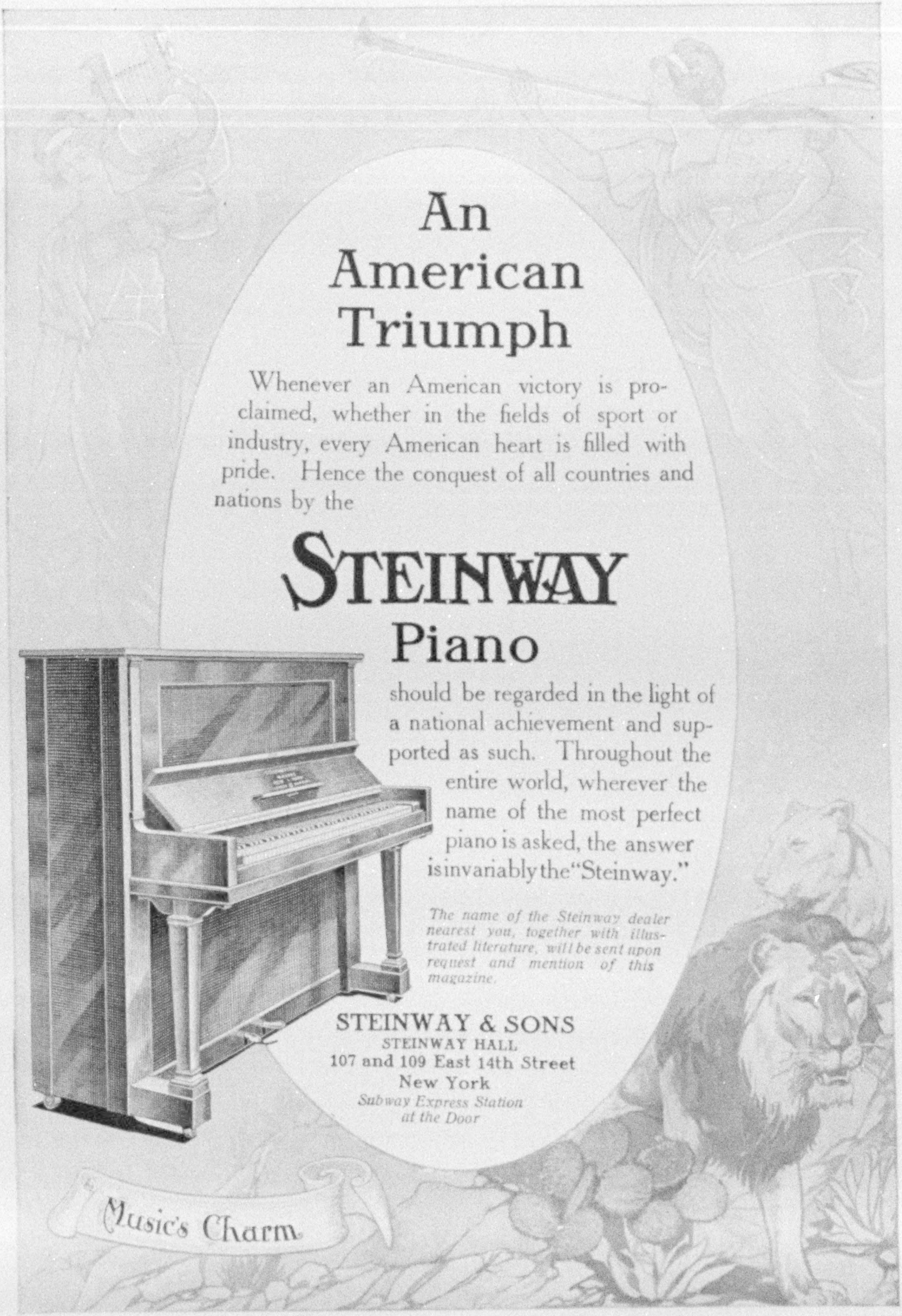

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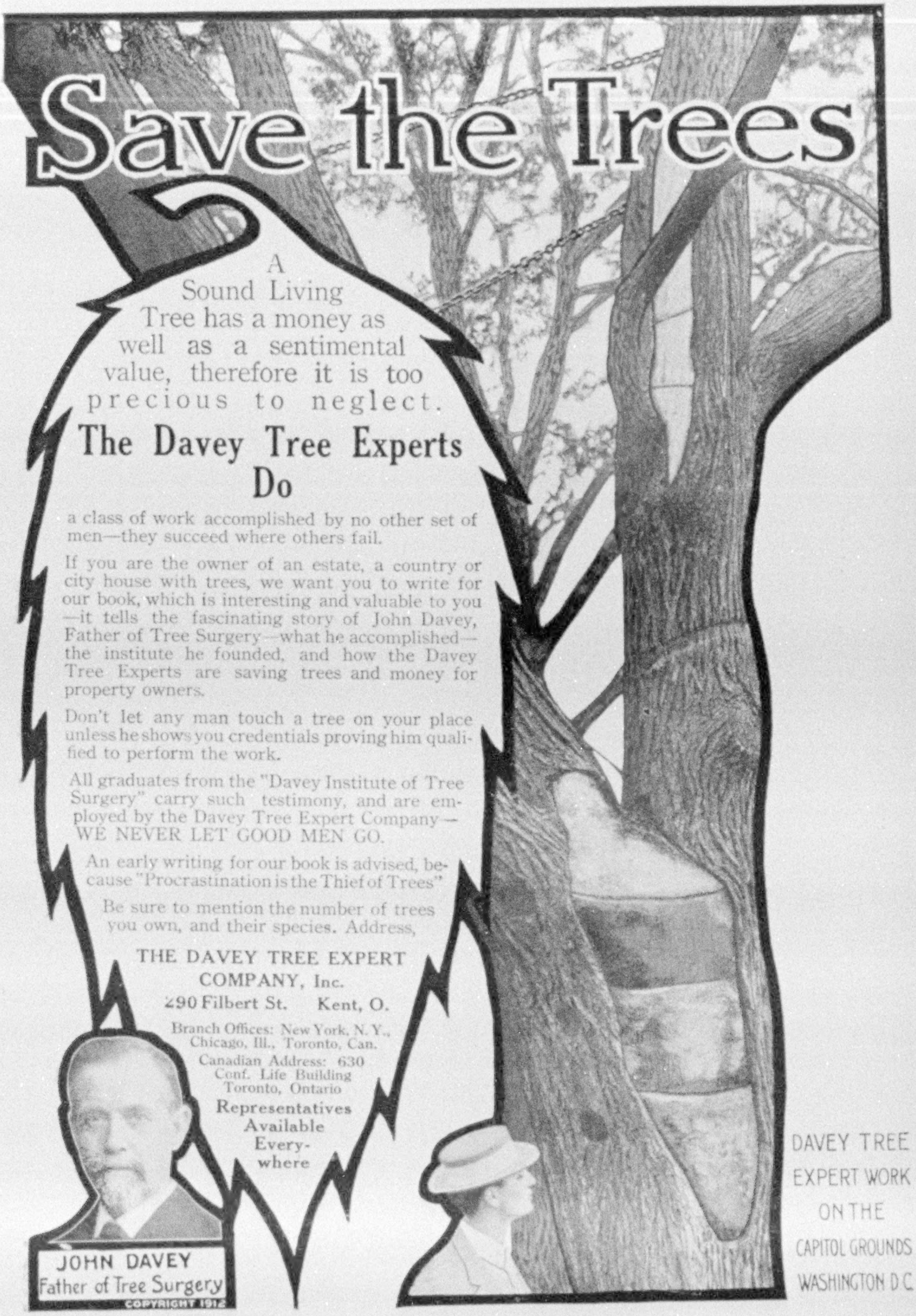

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VOL. XXIII, NO. 4 WASHINGTON APRIL, 1912

THE NATIONAL GEOGRAPHIC MAGAZINE

TAAL VOLCANO AND ITS RECENT DESTRUCTIVE ERUPTION

BY DEAN C. WORCESTER

SECRETARY OF THE INTERIOR OF THE PHILIPPINE ISLANDS

DISTANCE detracts amazingly from public appreciation of the magnitude of great calamities, and as the people of the United States have thus far gained their information relative to the recent great eruption of Taal Volcano chiefly, if not entirely, from meager newspaper reports, it is not strange that few of them even now realize that in the early morning of January 30, 1911, there occurred in the Philippine Islands an appalling disaster.

The destructive eruption of Taal Volcano which then took place is by no means its first outbreak within historic times. Taal is an old offender in this regard and we know that it was making trouble soon after the discovery of the Philippine Islands.

The town of Taal was founded by Augustinian friars in 1572, and in his description of this event Father Gaspar de San Agustin says that in Lake Bombon, on the south shore of which the town was located, "there is a volcano of fire, which is wont to spit forth many and very large rocks, which are glowing and destroy the crops of the natives."

The volcano was unquestionably very active at this time. In fact, Father Nada has stated that Taal was actually in eruption in 1572. No details of this eruption were recorded, so far as is now known, but it is certain that Father Albuquerque celebrated mass on Volcano Island with a view to tranquil the spirits of the panic-stricken natives.

In 1591 Father Alcantara performed a similar ceremony, because the volcano had begun to belch forth extraordinary masses of smoke.

Between 1605 and 1611 Father Tomás de Abreu not only said mass on the volcano, but had an immense cross of hard wood erected at the brink of the principal crater, for the reason that from this crater there had come frequent subterranean rumblings which had greatly terrified the inhabitants of neighboring villages.

In several chronicles there exist vague statements concerning eruptions in 1634 and in 1635.

In 1707 there occurred the first well-established and authentically recorded eruption. At this time a cone, which still exists and is called Binintiang Malaqui (see page 318), "burst forth with a tremendous display of thunder and lightning; but aside from fear and tremblings no damage was done in the towns situated on the shores of Lake Bombon." *

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*The translations of the accounts of early eruptions are taken from the Rev. Miguel Saderra Maso's paper on "The Eruption of Taal Volcano on January 30, 1911."

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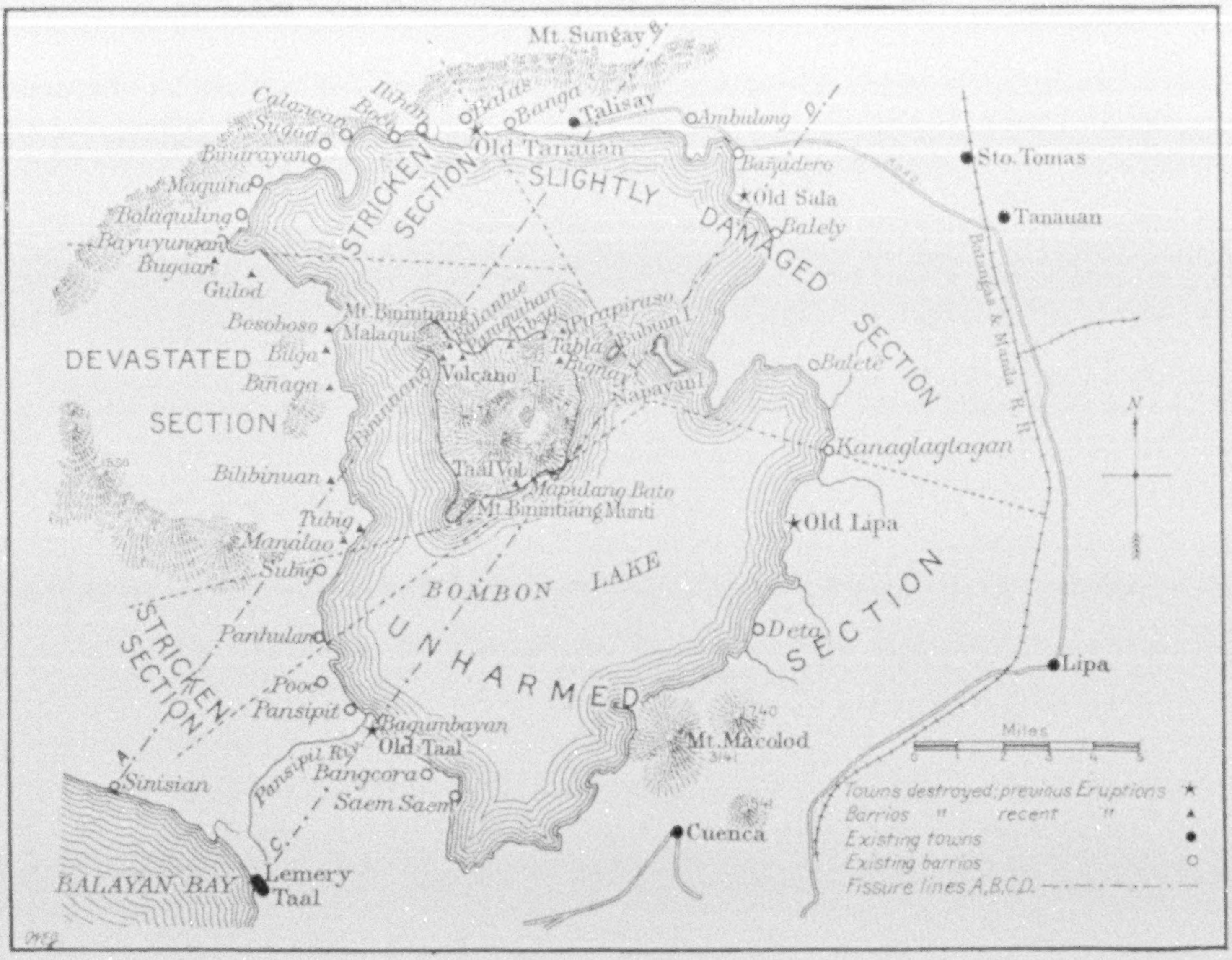
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Existing barrios ○
Fissure lines A, B, C, D.

MAP SHOWING AREA OF DEVASTATION BY THE LAST ERUPTION OF TAAL VOLCANO, AND ALSO THE TOWNS DESTROYED BY PREVIOUS ERUPTIONS

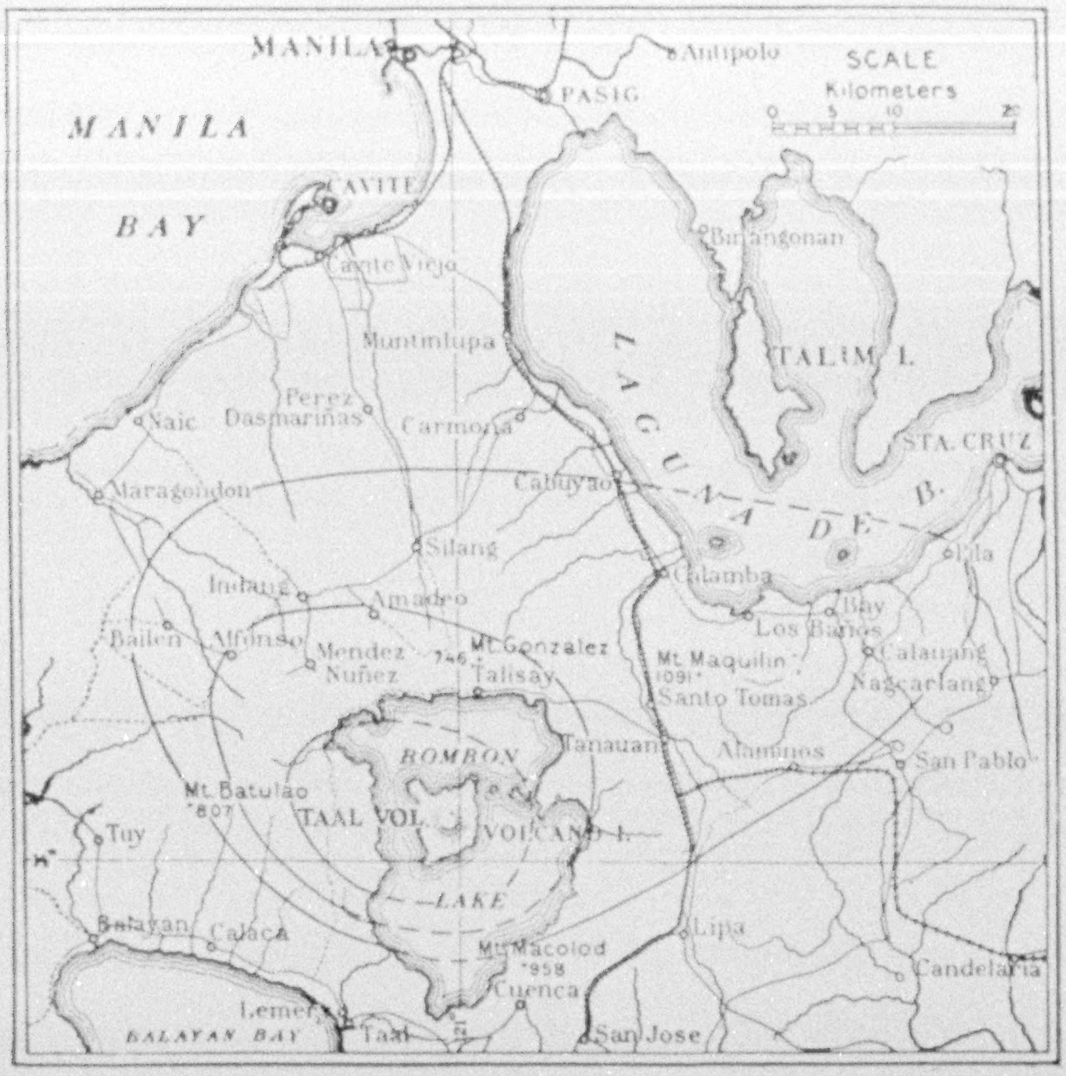
On September 24, 1716, there occurred a violent eruption, which has been described by Father Manuel de Arce as follows:

FISHES COOKED BY THE BOILING LAKE

"On September 24, 1716, at about 6 o'clock in the evening, a great number of detonations were heard in the air, and shortly after it became plain that the volcano in Lake Bombon had burst on its southeastern side, which faces Lipa, so that the whole point called Calauit appeared to be on fire. Later on the eruption seemed to spread into the lake, in the direction of Mount Macolod, which rises opposite the volcano on the southeastern shore of the lake. Great masses of smoke, water, and ashes rushed out of the lake, high up into the air, looking like towers. Simultaneously there was a great commotion in the earth which stirred up the water in the lake, forming immense waves which lashed the shores as though a violent typhoon were raging. Their fury was such that in front of the Convento of Taal, and in other places of the beach, a strip of more than 10 brazas [16.7 meters] in width was engulfed by the water, and the church was endangered.

"On the following days, Thursday, Friday, and Saturday, things continued in the same way, but by Sunday all the combustible material appears to have been consumed. This eruption killed all the fishes, large and small, the waves casting them ashore in a state as if they had been cooked, since the water had been heated to a degree that it appeared to have been taken from a boiling caldron. There was an all-pervading, pestilential stench of sulphur which greatly molested the inhabitants of the towns surrounding the lake.

"Sunday morning the sun broke



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MAP OF THE REGION AFFECTED BY THE GREAT ERUPTION OF JANUARY 30, 1911

The inner line incloses the area of devastation. The space between it and the next outer line shows the area of serious damage. The space included within the outermost line marks the area over which there was a considerable fall of "ash." A light fall of "ash" extended as far north as Manila and to a corresponding distance in other directions. The lighter ejecta were drifted to the northeast by the wind which prevailed at the time. The loss of life was confined to Volcano Island and to the mainland to the west included within the zone of devastation (see page 361).

through, but later torrential rains fell with thunder and lightning, some of the latter striking and the whole causing the greatest terror. Finally, however, the weather cleared, and of the whole tragedy there remained no other signs than the stench of sulphur and of the great quantity of dead fish cast upon the beach by the waves."

In 1729 there occurred an eruption, of which we have no adequate description.

In 1731 the volcano again burst forth. Father Torrubia has described this outbreak as follows:

"With terror we heard during one of the nights a continuous fire of heavy artillery, as if two mighty armies were engaged in battle. This was followed by a terrible earthquake of long duration, after which we heard only isolated detonations, not with the former frequency, but very much sharper. Their persistency caused us to pass the following day in considerable anxiety and fear. At nightfall we were informed that out of the depths of Lake Bombon, which is at a distance of eight leagues [34 kilometers, or 21 miles] there rose such a frightful and all-devouring conflagration that the whole region was panic-stricken.

"Curiosity led me to go and examine the terrible phenomenon which lasted during many days, accompanied by subterranean rumblings which caused the entire region to tremble. The moment when a report was heard, there appeared in the air, surrounded by sulphurous flames and pestilential smoke, enormous boulders, which built up an island from the bottom of the deep lake, said island

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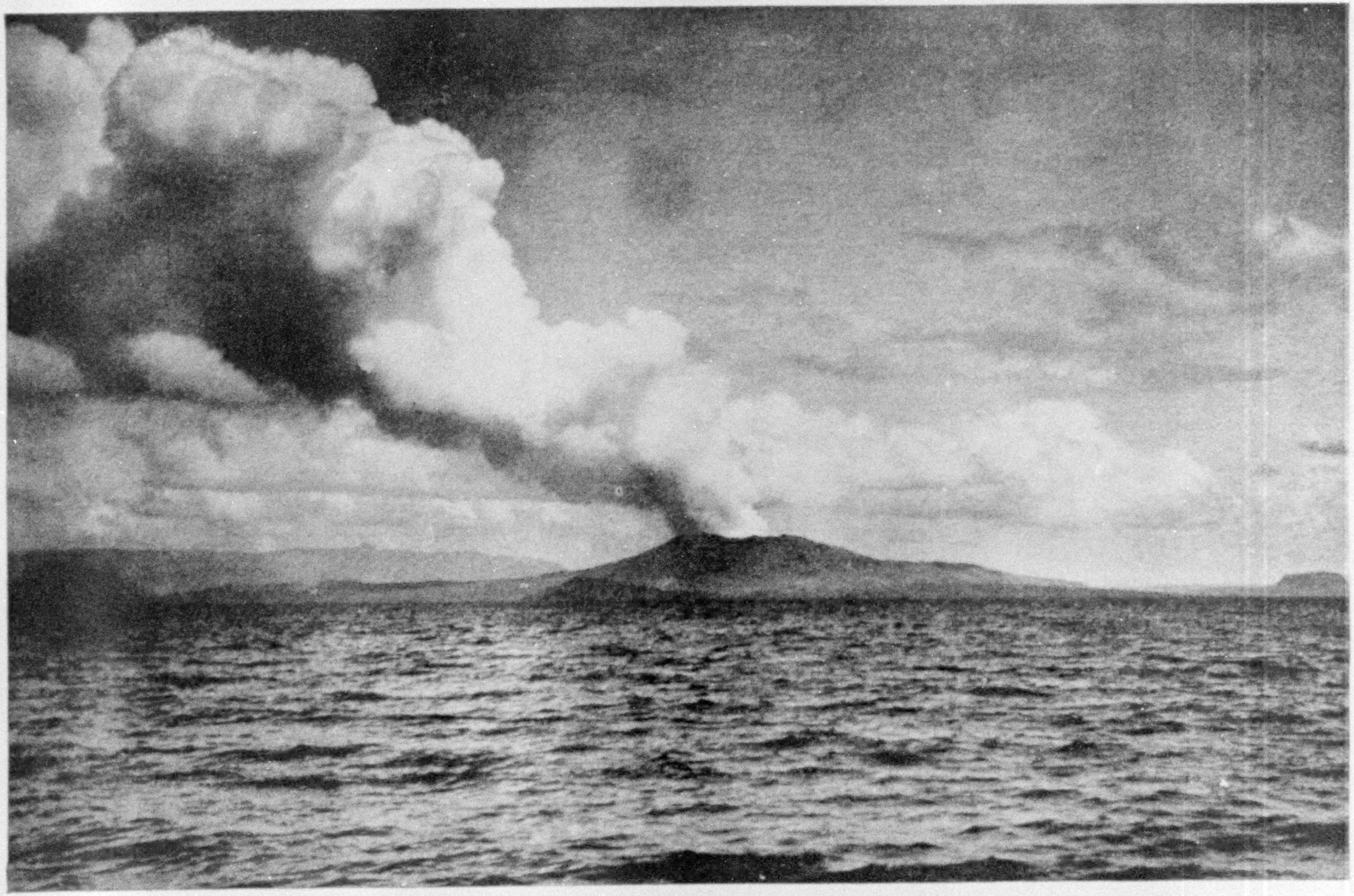

DISTANT VIEW OF TAAL VOLCANO FROM THE SOUTHWEST: BOMBON LAKE, SOMETIMES CALLED TAAL LAKE, IN THE FOREGROUND having a diameter of one mile, more or less. After the conflagration had become extinct, I myself saw this island from a place near Tanauan. It is composed entirely of rocks with an admixture of other materials ejected during the eruption, without any earth whatever. The rocks, subject to the action of fire ever since their formation, clearly reveal the hand which placed them there. This all-consuming fire made the water boil, cooked the fishes, and left the impress of its fierceness on the very rocks."

In spite of the violence of this eruption, no damage was done to the neighboring towns.

On August 11, 1749, there began a very violent outburst. It has been most graphically described by an eyewitness, Father Buencuchillo, who says:

PYRAMIDS OF ASHES

"During the night of that day the top of the mountain burst out with tremendous force from the same crater which since ancient times used to emit fire and rocks. The course of events was this: At about 11 o'clock of the night I had noticed a rather extensive glare over the top of the island; but entirely unaware of what this might portend, I paid no special attention to it and retired to rest. Around 3 o'clock in the morning of the 12th, I heard something like heavy artillery fire and began to count the reports, taking it for granted that they came from the ship which was expected to arrive from New Spain [Mexico] and which, according to an ancient custom, on entering Balayan Bay saluted Our Lady of Caysasay. I thought it strange, however, when I found that the number of detonations already exceeded one hundred, and still they did not cease. This caused me to rise with some anxiety as to what could be the matter; but my doubts were quickly dispelled, as at this moment there appeared four excited natives who shouted: 'Father, let us leave this place! The volcano has burst out and all this noise and racket comes from it!'

"By this time it began to dawn, and we saw the immense column of smoke which rose from the summit of the island, while several smaller whiffs issued from other openings. I confess that the spectacle, far from frightening me, rather delighted my eyes, especially when I noticed that also from the water there arose enormous columns of sand and ashes, which ascended in the shape of pyramids to marvelous heights and then fell back into the lake like illuminated fountains.

"Some of the pyramids surged toward north, others toward east, the sight lasting until 9 o'clock of the morning. At the latter hour there was felt a furious earthquake which left nothing movable in its place within the convento. This forced me to flee to higher ground, especially as I noticed that some of the horrid pyramids shooting forth from the water were coming toward the town and place where we were. When they reached that part of the lake's shore which was known as 'tierra destruída' [waste land?], they ruined that tract entirely, and with a second earthquake, not less fierce than the one shortly preceding, it sank into the lake. To this very day, the branches of the trees buried beneath the water can be seen from the distance.

"During these terrible convulsions of the earth fissures opened in the ground amid horrifying roars, said fissures extending from the northern and northeastern beach of the lake as far as the neighborhood of the town of Calamba. Here, as well as elsewhere, the whole shore of Lake Bombon has been disturbed. The entire territory of Sala and part of that of Tanauan have been rendered practically uninhabitable: the water-courses have been altered, former springs have ceased to flow and new ones made their appearance; the whole country is traversed by fissures, and extensive subsidences have occurred in many places.

"During my flight I saw a great many tall trees, such as cocoanut and betel-nut palms, either miserably fallen or so deeply buried that their tops were within reach of my hands. I likewise saw several houses which formerly, in accordance with Philippine custom, had their

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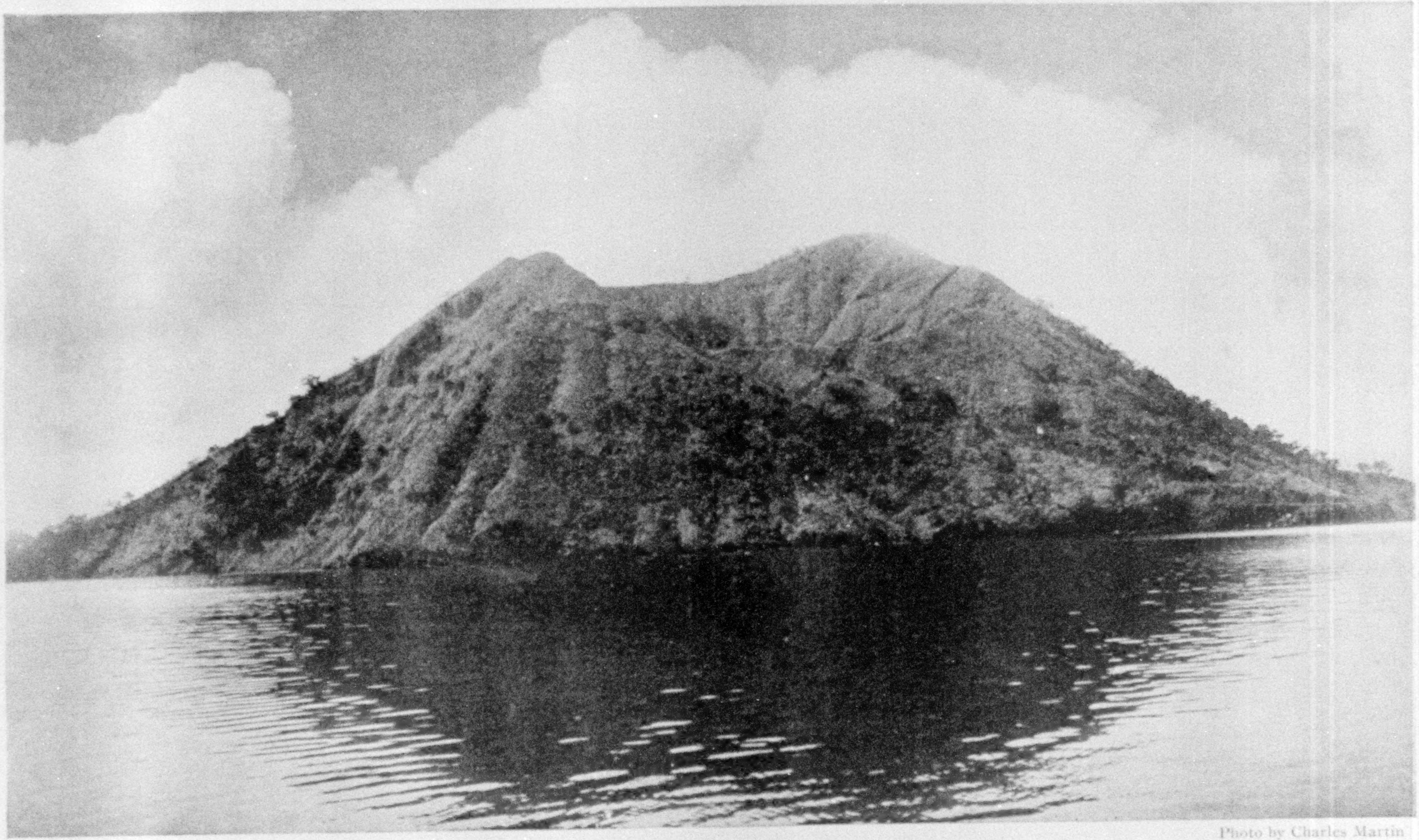

Photo by Charles Martin

A PEACEFUL NEIGHBOR OF MOUNT TAAL, BININTIANG MALAQUI

This crater, at the extreme northwestern extremity of Volcano Island, "burst forth with a tremendous display of thunder and lightning" in 1707, but it has been quiet ever since (see page 313) floors raised several yards above ground, but had sunk to such a degree that the same ladder which once served to ascend into them was now used to descend to them. The most remarkable thing about this is that the natives tranquilly continue occupying them, though they find themselves buried alive.

"It rained ashes in considerable quantity, and that part of them which remained suspended in the air formed a vast cloud, which grew so dense as to cause real darkness during the hours of broad daylight."

On May 15, 1754, there began the most violent and long-continued eruption which has occurred within historic times. The same good priest who so tranquilly observed the eruption of 1749 and so graphically recorded his observations witnessed this eruption also, and again his description is most interesting. He says:

"A LIVING PICTURE OF SODOM"

"On May 15, 1754, at about 9 or 10 o'clock in the night, the volcano quite unexpectedly commenced to roar and emit, sky-high, formidable flames intermixed with glowing rocks, which, falling back upon the island and rolling down the slopes of the mountain, created the impression of a large river of fire. During the following days there appeared in the lake a large quantity of pumice-stone which had been ejected by the volcano. Part of these ejecta had also reached the hamlet of Bayuyungan and completely destroyed it.

"The volcano continued thus until June 2, during the night of which the eruption reached such proportions that the falling ejecta made the entire island appear to be on fire, and it was even feared that the catastrophe might involve the shores of the lake. From the said 2d of June until September 25, the volcano never ceased to eject fire and mud of such bad character that the best ink does not cause so black a stain.

"During the night of September 25 the fire emitted was quite extraordinary and accompanied by terrifying rumblings. The strangest thing was, that within the black column of smoke issuing from the volcano ever since June 2, there frequently formed thunder-storms, and it happened that the huge tempest cloud would scarcely ever disappear during two months.

"At daybreak of September 26 we found ourselves forced to abandon our dwelling for fear lest the roofs come down upon us under the weight of ashes and stones which had fallen upon them during that hapless night. In fact, some weaker buildings collapsed. The depth of the layer of ashes and stones exceeded two 'cuartas' [45 centimeters, or 18 inches], and the result was that there was neither tree nor other plant which it did not ruin or crush, giving to the whole region an aspect as if a devastating conflagration had swept over it. After this the volcano calmed down considerably, though not sufficiently to offer any prospect of tranquillity.

"During the night of November 1 Taal resumed its former fury, ejecting fire, rocks, sand, and mud in greater quantities than ever before. On November 15 it vomited enormous boulders, which, rolling down the slopes of the island, fell into the lake and caused huge waves. These paroxysms were accompanied by swaying motions of the ground, which caused all the houses of the town to totter. We had already abandoned our habitation and were living in a tower, which appeared to offer greater security; but on this occasion we resolved that the entire population retire to the sanctuary of Caysasay, only the 'administrador' and myself to remain on the spot.

"At 7 in the evening of November 28 occurred a new paroxysm, during which the volcano vomited forth such masses of fire and ejecta that in my opinion all the material ejected during so many months, if taken together, would not equal the quantity which issued at the time. The columns of fire and smoke ascended higher than ever before, increasing every moment in volume and setting fire to the whole island, there being not the smallest portion of the latter which was not covered by the smoke and the glowing rocks and ashes. All this was accompanied by terrific lightning and thunder above and violent shocks of earthquakes underneath. The cloud of ejecta, carried on by the wind, extended itself toward west and south, with the result that we saw already some stones fall close to our shore. I therefore shouted to all those who were still in the town to take to flight, and we all ran off in a hurry; otherwise we would have been engulfed on the spot, as the waves of the angry lake began already to flood the houses nearest to the beach.

"We left the town, fleeing from this living picture of Sodom, with incessant fear lest the raging waters of the lake overtake us, which were at the moment invading the main part of the town, sweeping away everything which they encountered. On the outskirts of the town I came upon a woman who was so exhausted by her burden of two little children and a bundle of clothing that she could proceed no farther. Moved by pity, I took one of the toddlers from her and carried him, and the little *indio*, who had been wailing while in the arms of his mother, stopped short when I took him into mine and never uttered a sound while I was carrying him a good piece of the way.

"Having reached a secure place on elevated ground at a distance of about half a league [2 kilometers] from the town, we halted in a hut to rest a little and take some food. From this spot the volcano could be contemplated with a little more serenity of mind. It still continued in full fury, ejecting immense masses of material. Now I also observed that the earth was in continuous swaying motion, a fact which I had failed to notice during the excitement and fear of the flight.

"Shortly afterwards the volcano subsided almost suddenly; its top was clear and apparently calm. We therefore returned on the following day, the 29th, to the town with the intention of surveying the havoc wrought during the preceding night.

"The 29th had dawned calm, but while we were still trying to persuade ourselves that the tragedy was over and the volcano had exhausted its bowels, at about 8 o'clock we heard a crash, and then I noticed that smoke was rising from the point of the island which looks toward east. The smoke spread very gradually as far as the crater of the volcano, while there were many whiffs issuing from points in the direction of another headland. I realized that the island had opened in these places, and fearing that if a crater should open below the water an explosion might follow much more formidable than the preceding ones, I mounted a horse and retired permanently to the sanctuary of Caysasay.

THE SKY WAS SHROUDED IN THE BLACKNESS OF NIGHT FOR THREE DAYS

"Between 3 and 4 o'clock in the afternoon of the said 29th, it began to rain mud and ashes at Caysasay (12 miles from the volcano) and this rain lasted three days. The most terrifying circumstance was that the whole sky was shrouded in such darkness that we could not have seen the hand placed before the face had it not been for the sinister glare of the incessant lightnings. Nor could we use artificial light, as this was extinguished by the wind and copious ashes, which penetrated everywhere. All was horror during those three days, which appeared rather like murky nights, and we did not occupy ourselves with anything but see to it that the natives swept off the roofs the large quantities of ashes and stones which kept on accumulating upon them and threatened to bring them down upon us, burying us alive beneath their weight. But fearing that even these precautions might prove unavailing, we three Europeans—viz., Father Prior, the alcalde, and myself—the only ones who were at the time in the Convento of Caysasay, took refuge on the landing of the stairs as the safest place, and awaited there whatever God might dispose with regard to us. To all this was added incessant thunder and lightning, and it really looked as if the world was going to pieces and its axis had been displaced.

"During the night of the 30th we had not a moment of repose, as every moment we heard the loud crash of houses collapsing under the load of stones, mud,

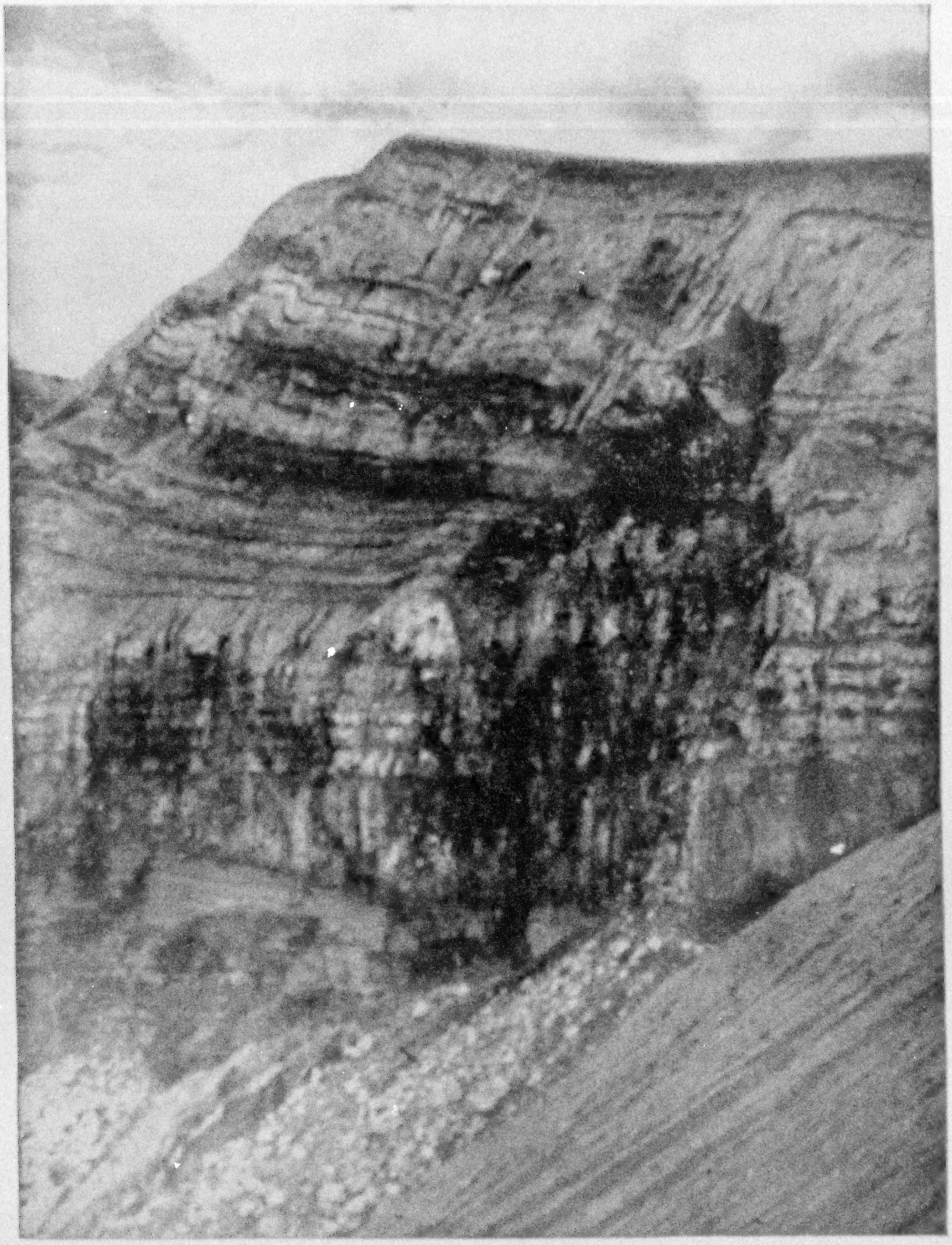

Photo by Dean C. Worcester

A PORTION OF THE CRATER WALL OF TAAL VOLCANO SHOWING STRATIFICATION

The walls of this crater often show quite bright colors during the rainy season, but turn dingy gray during the dry season (see page 331)

and ashes piled upon them, and feared that the turn of the convento and church of Caysasay would come next. Shortly before daybreak of December 1 there was a tremendous crash, as if the house were coming down over our heads: the roof of the apsis of the church had caved in! Not long afterward the roof of the kitchen gave way with a similar thud. Both were tile roofs.

"The 1st of December broke somewhat clear and our eyes contemplated everywhere ruins and destruction. The layer of ashes and mud was more than five spans [1.10 meters, or 43 inches] thick, and it was almost a miracle that the roofs of the church and convento sustained so great a weight. We caused the bulk of the material to be removed, while new continued to fall on that day and the following, on which latter the direction of the wind changed, carrying the ejecta toward Balayan. On the 3d and 4th we had a formidable typhoon, and thereafter the volcano quieted down.

"Soon afterward I resolved to visit

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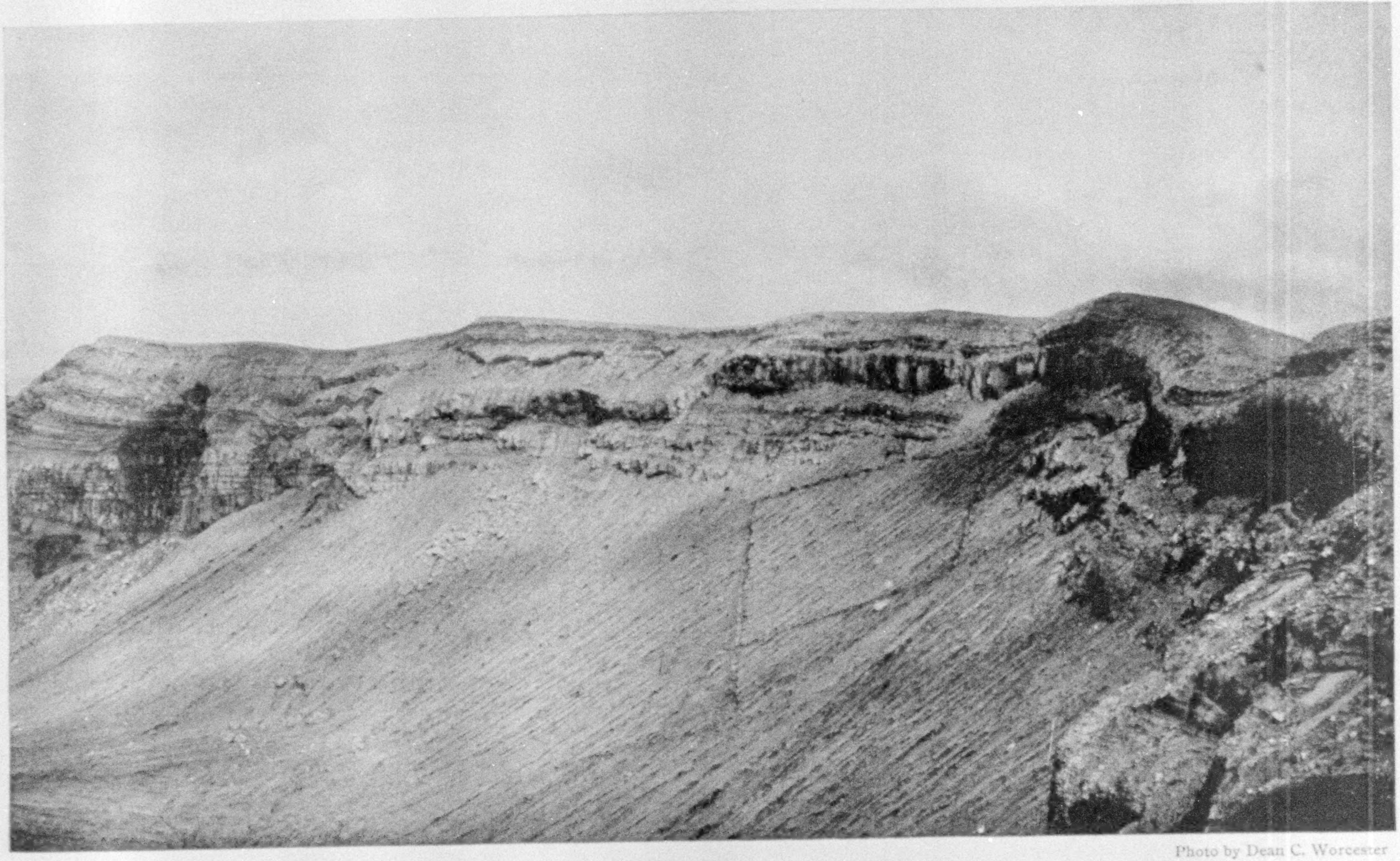

Photo by Dean C. Worcester

THE ZIGZAG PATH LEADING INTO THE MAIN CRATER OF TAAL VOLCANO (SEE PAGE 331)

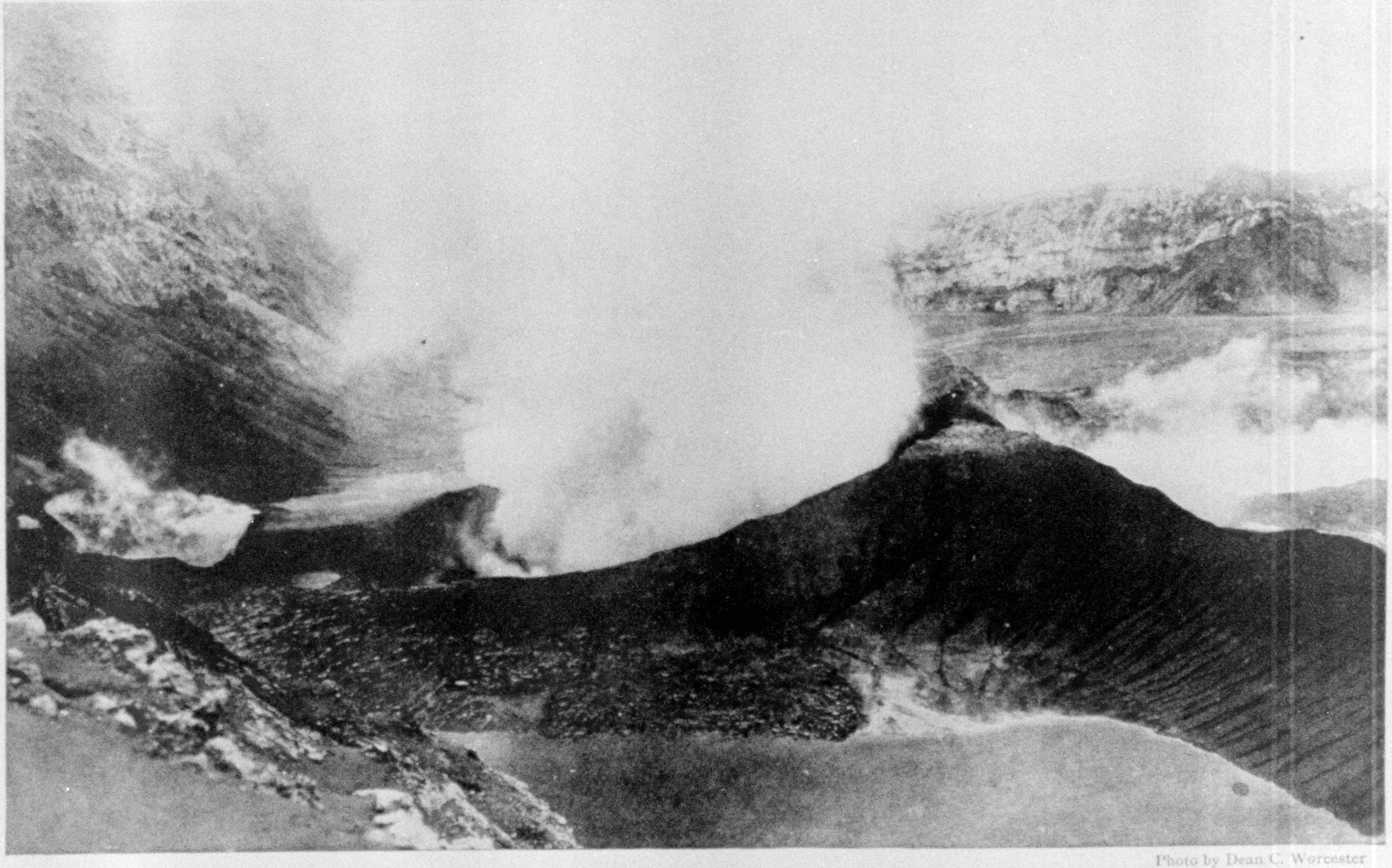

Photo by Dean C. Worcester

THE 1904 CRATER IN ACTION

A portion of the temporary red lake shows in the foreground (see page 334)

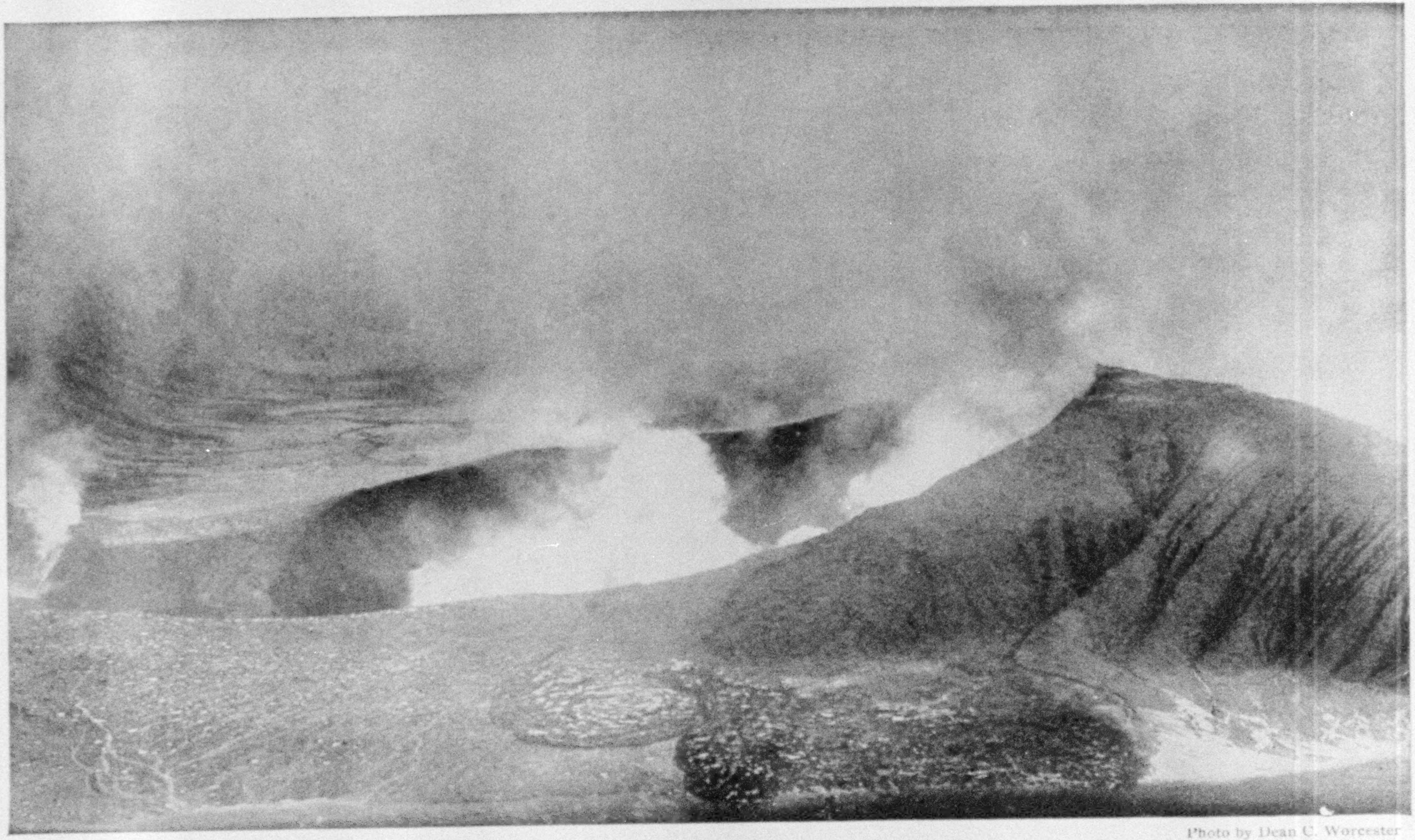

Photo by Dean C. Worcester

NEAR VIEW OF THE 1904 CRATER

Note the mud flow in the foreground. Note also the pits produced by falling rock (see page 334)

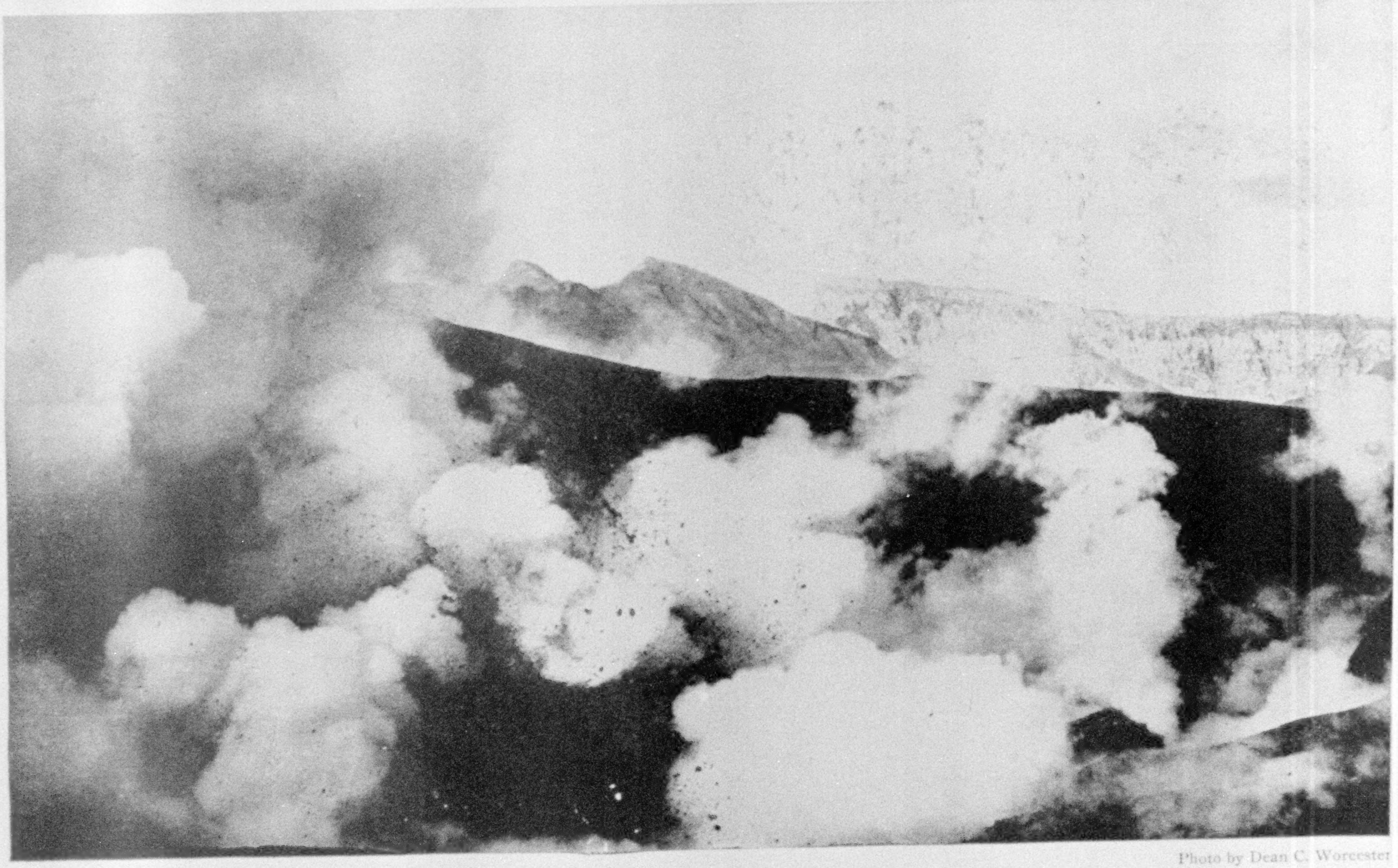

Photo by Dean C. Worcester

VERY NEAR VIEW OF THE 1904 CRATER IN ACTION: NOTE THE BOULDERS BEING EJECTED (SEE PAGE 334)

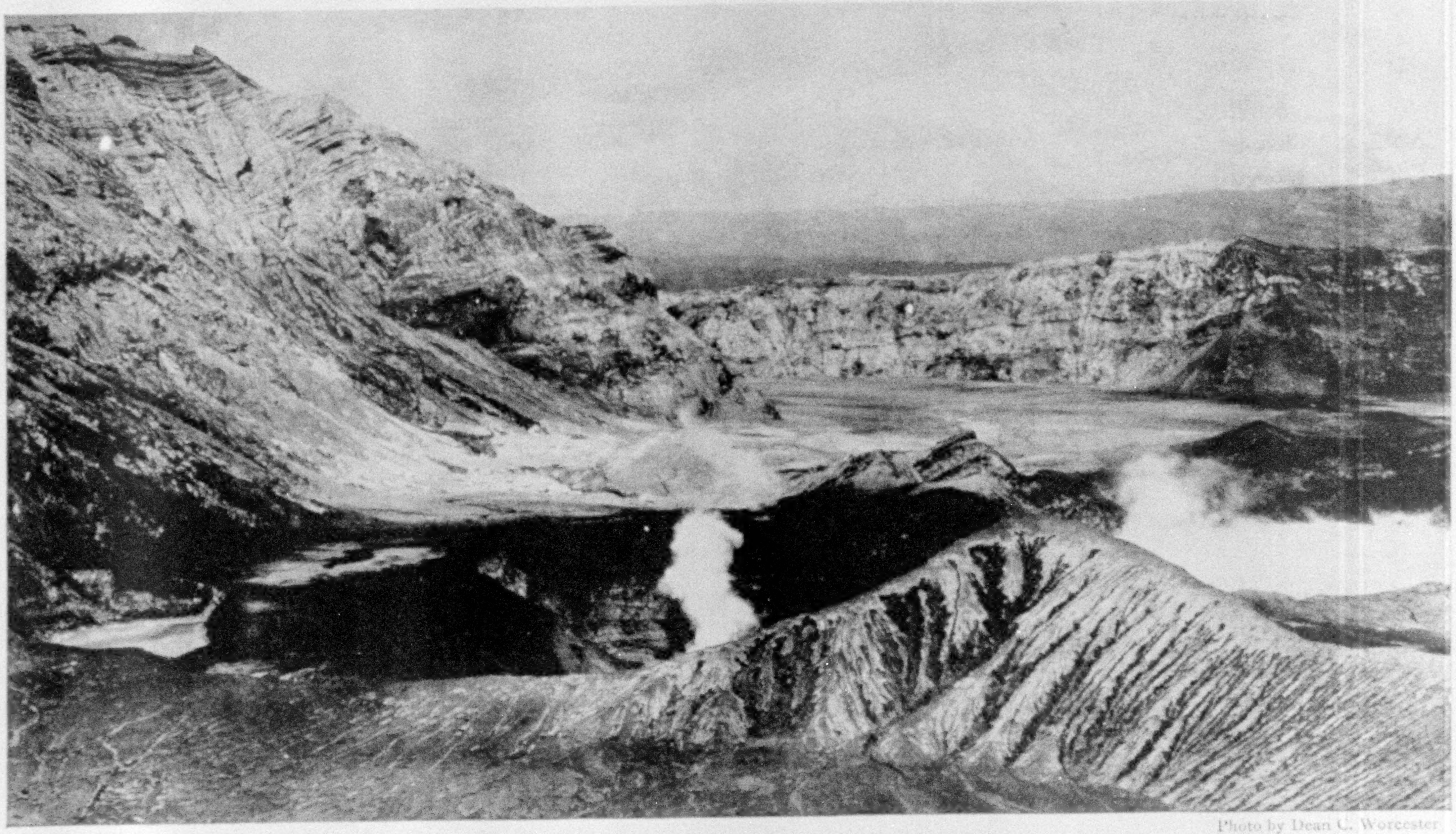

Photo by Dean C. Worcester

THE 1904 CRATER QUIESCENT (SEE PAGE 334)

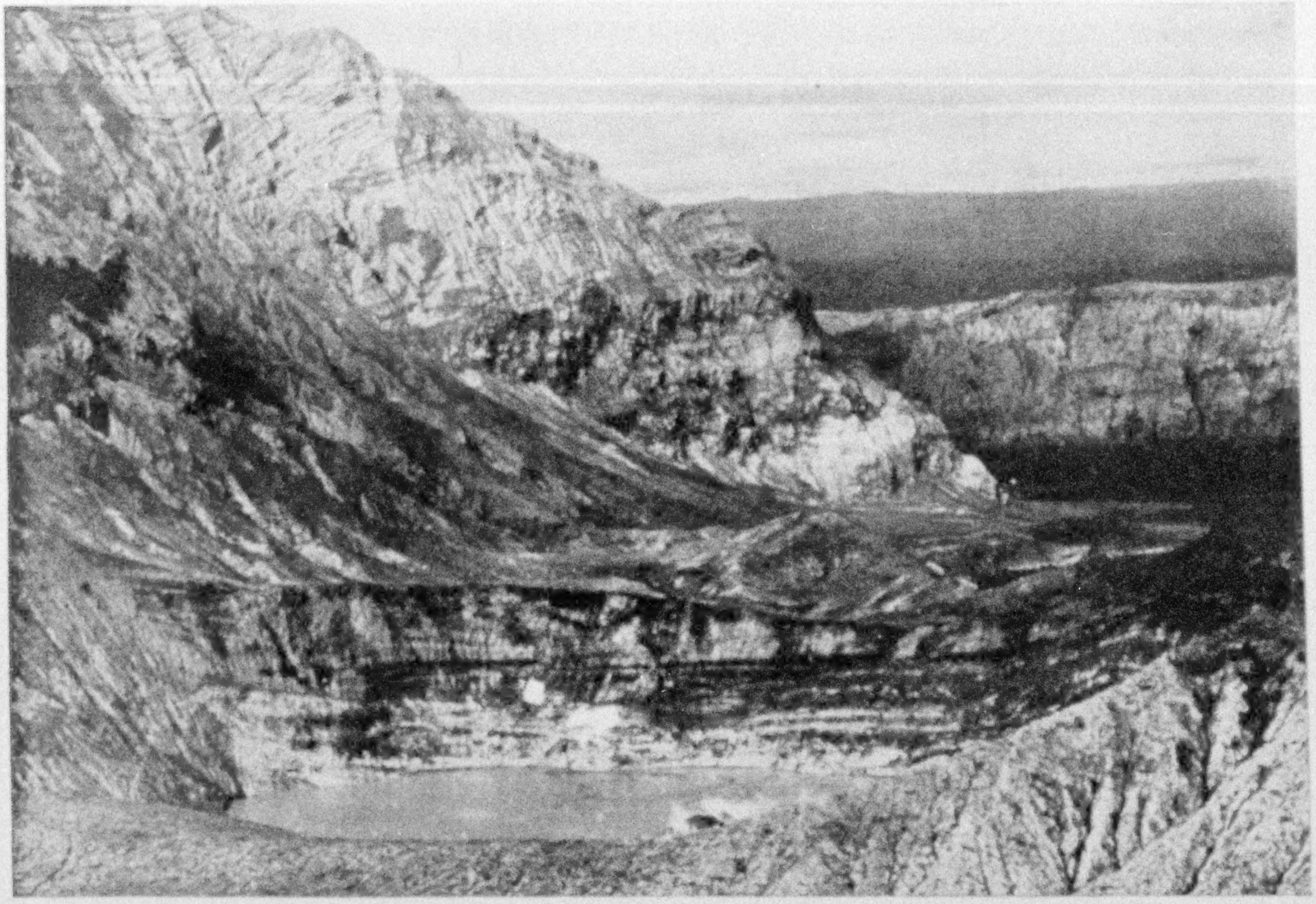

Photo by Dean C. Worcester

LATER: THE 1904 CRATER FILLED WITH WATER

my town of Taal; nothing was left of it except the walls of the church and convento. All the rest, the government house, the walks of the rope factory, the warehouses, everything was buried beneath a layer of stones, mud, and ashes more than 10 spans thick; only here and there could be seen an upright post, the only remnant of a comfortable dwelling. I went down to the river and found it completely filled up, with a boat belonging to the alcalde and many of private persons buried in the mud. After incredible efforts I finally succeeded in unearthing, in what had once been the church and sacristy, the chests which contained the sacred vestments and vessels. Nearly all of them were demolished by the rocks and beams which had fallen upon them and filled with foul-smelling mud that had ruined or disfigured their contents. With the aid of some natives of Bauang I likewise recovered some property from among the ruins of the convento.

"Twelve persons are known to have perished—some carried away by the waves of the lake, others crushed beneath their collapsing houses. Thus the beautiful town of Taal remains a deserted wilderness and reduced to the utmost misery, while once it was one of the richest and most flourishing places. In the villages to the west of the lake, which were the greater and better part, all the houses have either collapsed under the load of material which had been piled upon them or have disappeared completely, swept away by the waves, which in these places were so violent that they dug three ditches or channels, too wide and deep to be forded, and thus rendered impassable the road which joins the town with Balayan. In other parts of the lake shore have likewise opened many cracks and occurred very extensive slides. The worst of all is that the mouth of the river Pansipit having been blocked, the lake is rising and invading the towns of Lipa and Tanauan, both being on the lowest level and inundating their buildings. All the animals of whatever kind have perished, some by being buried, others by drowning, the rest by starving,

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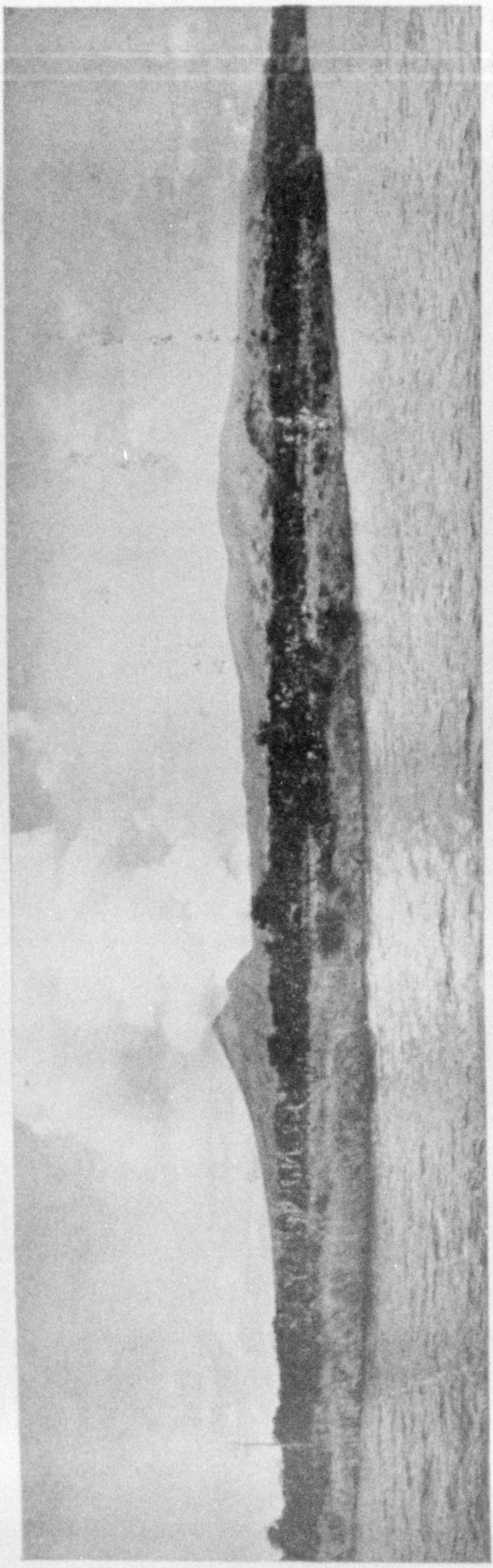

Photo by Charles Martin

PANORAMIC VIEW OF TAAL VOLCANO FROM BOMBON LAKE

This photograph was taken during a period of comparative quiet the afternoon before the great eruption which completely wiped out all trees and grass, leaving the entire island swept perfectly clean (see pages 355 and 356)

as not a green blade remained anywhere.

"The same fate as Taal has befallen the towns of Lipa, Tanauan, and so much of Sala as still existed. These towns, together with Taal, lay around the lake, being situated within easy reach of it and less than one league [4 kilometers] from the volcano. The bulk of the population left this neighborhood and settled in more distant places. Thus out of 1,200 taxpayers, whom Taal contained formerly, hardly 150 remain in the poorest and least respectable villages, which suffered little from the rain of ashes."

This eruption caused the final abandonment of the sites of the old towns of Taal, Lipa, Tanauan, and Sala and the reëstablishment of the first three in new and safer places. The sites of these old towns are shown on the map on page 314.

In this instance the period of activity lasted from the 15th of May until early in December. The titanic energies emanating from this volcanic center were apparently then temporarily exhausted, and there followed a period of quiet lasting until March, 1808, when there occurred an outburst which did much damage to neighboring towns, owing to the great quantity of ejecta. In the vicinity of the volcano there were places where the ground was covered with "ashes" to a depth of some 33 inches. This eruption is said to have modified profoundly the form of the principal crater.

The next serious disturbance occurred on July 19, 1874, when there was an eruption of gases and "ashes" which killed all the live stock on Volcano Island and withered or burned the vegetation on the western slopes of the crater.

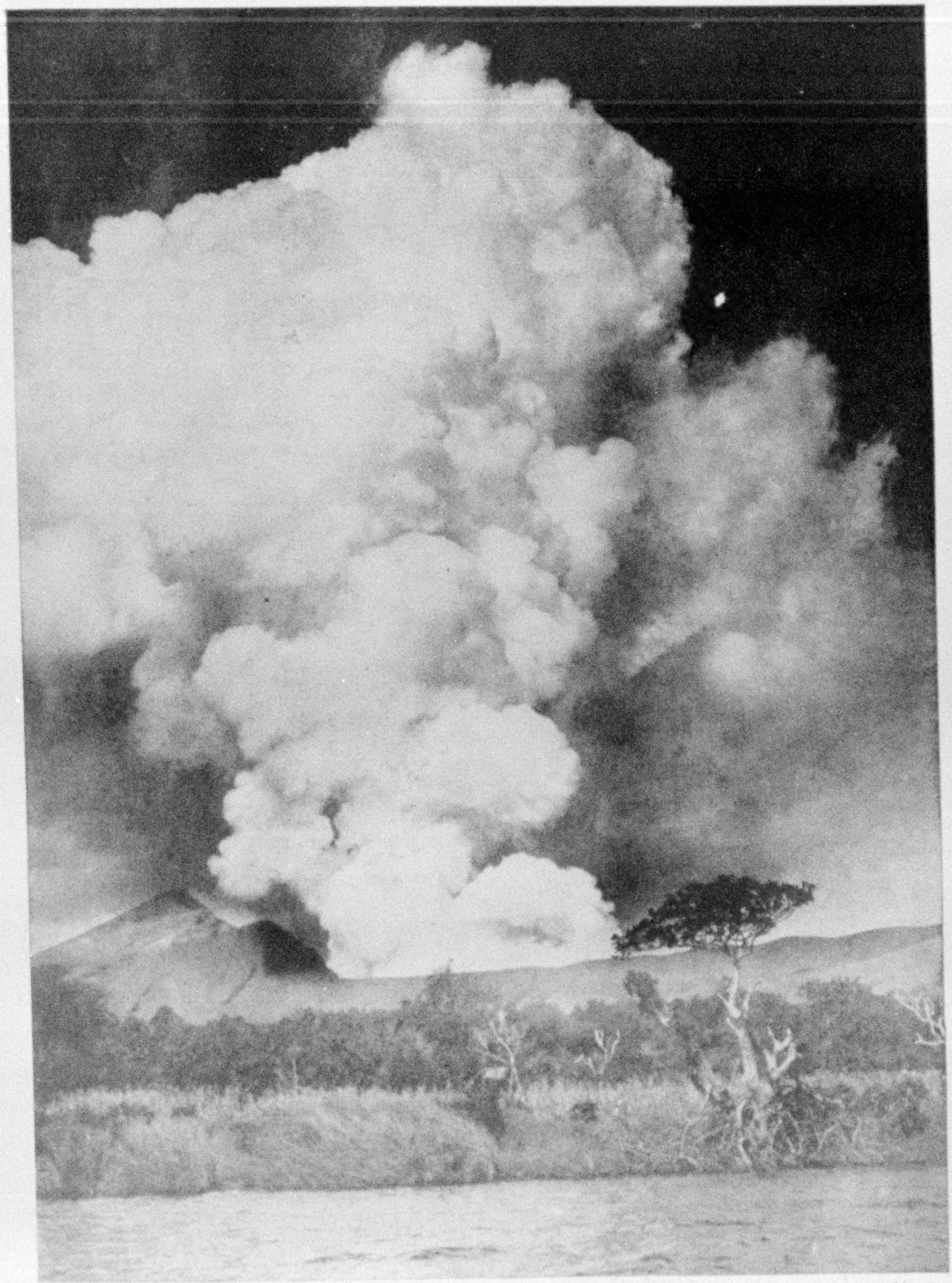

Photo by Charles Martin

TAAL VOLCANO FROM BOMBON LAKE THE DAY BEFORE THE GREAT ERUPTION

After taking this photograph, notwithstanding the fury of elements depicted in the illustration, Mr. Martin proceeded to the brink of the volcano to photograph it at close range (see pages 328, 333, and 334).

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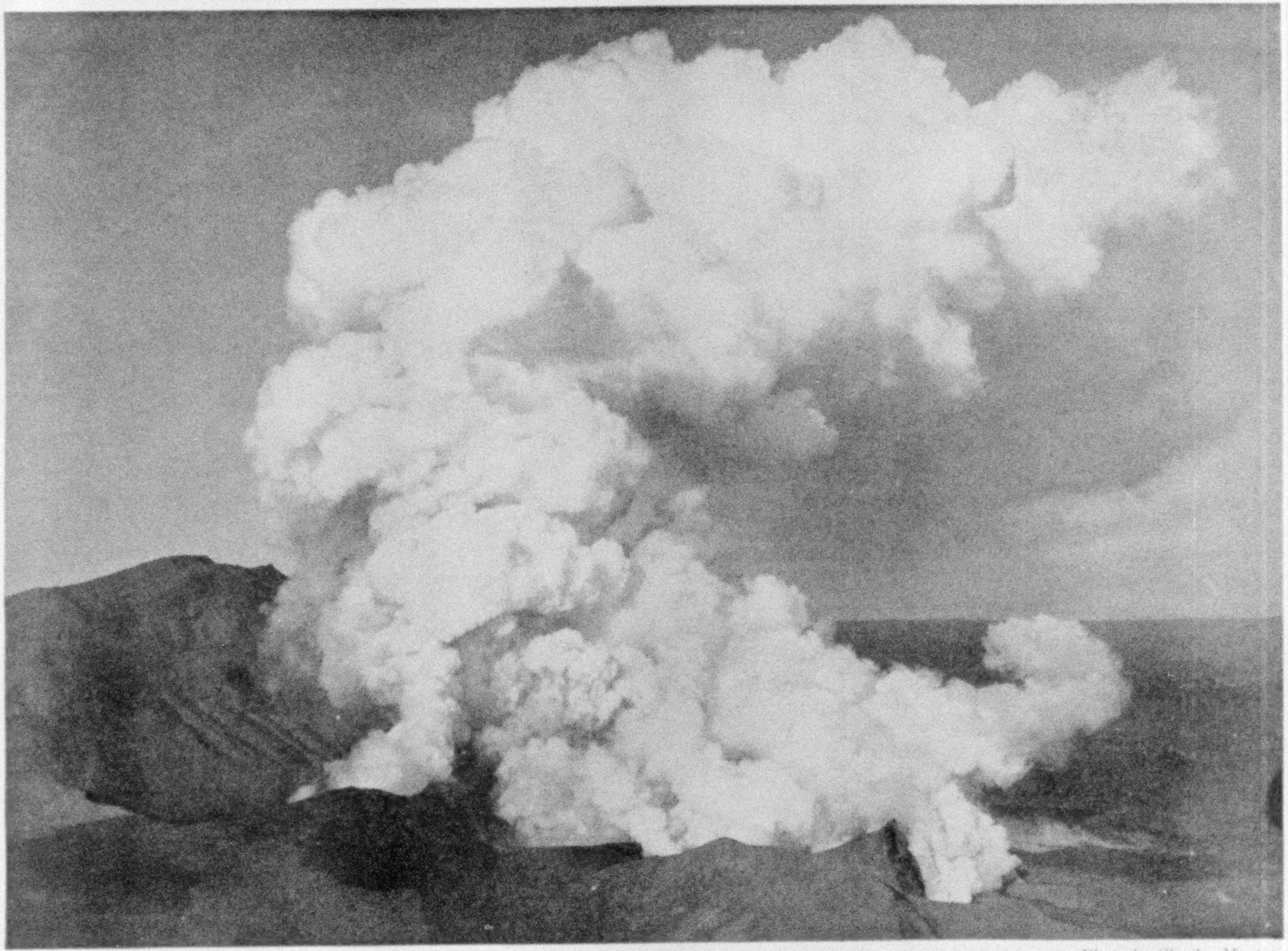

Photo by Charles Martin

THE THREATENING CLOUD RISING FROM THE CRATER OF TAAL VOLCANO AND DRIFTING ACROSS CAVITE PROVINCE ON THE DAY BEFORE THE GREAT ERUPTION

The 1904 crater to the left; the main crater in the center; the small new crater at the right

From November 12 to 15, 1878, there was an eruption during which the entire island was covered with "ashes."

MY FIRST VISIT TO TAAL VOLCANO

My personal acquaintance with Taal Volcano began in June, 1888. While attempting to make the Luzon coast from Mindoro in a small native sail-boat, in company with a fellow ornithologist, Dr. Frank S. Bourns, our frail craft was caught and badly battered in tide rips, and was ultimately dashed upon the coast of the Bay of Batangas.

We made our way overland on foot to the town of the same name, walking into a quicksand after dark and having our shoes pulled off before we could extricate ourselves. When we finally reached our destination, hungry and exhausted, we despatched men to save such portion of our baggage as had not been destroyed, slept the clock around, and then visited the Spanish provincial governor, in order to secure permission to proceed to Manila on a local steamer which was loading with coffee at the pier.

The governor, who was a most kindly man, assured us that we ought not to fail to visit Taal Volcano, even if we had to travel all night in order to get back in time to catch our steamer. We acted on his advice and I have always felt greatly indebted to him for it.

We reached the volcano early the following morning after a rough journey by *carromata* and native boat. The ascent began with one false start, which ended in our being turned back by an impassable fissure, but on our second attempt we reached the rim of the large "old crater" at its lowest point, where it has an elevation of only 369 feet above the waters of the lake.

The view that opened before us was one of unsurpassed grandeur and beauty. We had ascended the eastern slope of the volcano. There lay at our feet a great depression, roughly circular and approximately a mile in diameter. Its walls were in most places nearly, or quite, perpendicular (page 321). They were beautifully stratified and brightly colored. Immediately in front of us was a lunette-shaped fragment of a second crater wall, the remainder of which had long since disappeared.

On the floor of the main crater there were three brilliantly colored lakes, of which the northernmost was blue, the central one yellow, and the southernmost a vivid emerald green. The yellow and green lakes were boiling violently, and from an opening under the southern point of the crater fragment above mentioned there arose, with a steady roar and occasional subterranean explosions, an immense column of steam and sulphur fumes. Numerous solfataras on the floor and sides of the crater spat forth poisonous vapors and contributed assorted hissings to the general chorus of strange and awe-inspiring sounds.

Immediately in front of us the slope of the crater wall was somewhat less abrupt than elsewhere, and we saw extending down to the crater floor traces of a zigzag path (see picture on page 322), said to have been constructed by a lovesick governor to satisfy the caprice of his enamorata, who desired to descend into the crater.

Lured on by that strange impulse which so often leads people into foolish adventures, we scrambled down this apology for a path, finding the main crater floor so hot that we were forced to stand first on one foot and then on the other to keep the soles of our shoes from scorching. We climbed the fragment of the inner crater wall, worked along it to a point immediately above the opening from which was steadily issuing a great column of fumes and steam, craned our necks over the edge and stared down into the seemingly bottomless depths below.

We then retraced our steps and, like the idiots that we were, endeavored to approach one of the boiling lakes in order to secure samples of the water. Soon the ground began to ring hollow under our feet. At this moment one of our Filipino attendants broke through the thin crust on which we were standing and sank to his knees in boiling mud, scalding his legs so that the skin came off. We promptly retraced our steps and climbed up the crater wall, which proved to be a very different undertaking from

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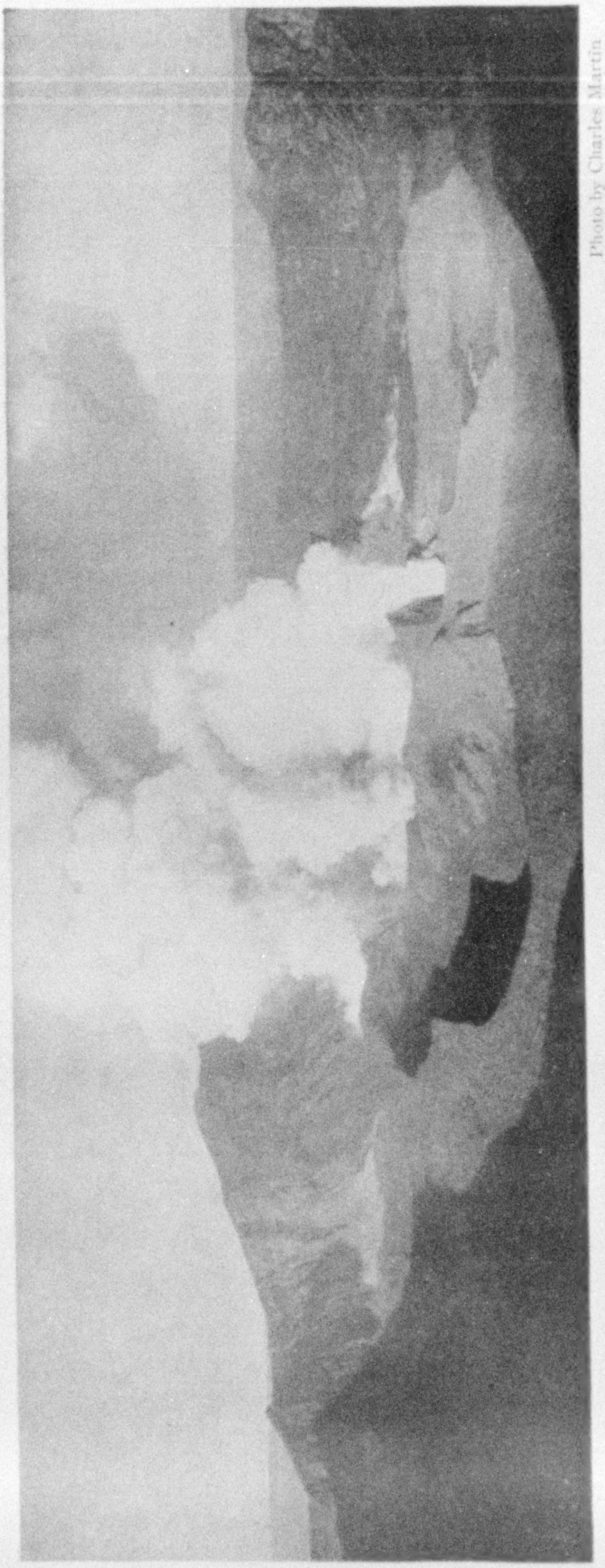

Photo by Charles Martin

PANORAMIC VIEW OF THE CRATER OF TAAL VOLCANO, LOOKING SOUTHWEST

This photograph was taken the day before the great eruption

descending it. After a brief rest on the rim we reluctantly turned our backs on a view which was then the grandest I had ever seen, and which made a lasting impression on me.

HUGE BOULDERS WERE HURLED SKYWARD

Upon my return to the Philippines, in 1900, I promptly renewed my acquaintance with Taal Volcano, finding the crater little changed, although the discharge of steam and other vapors had temporarily ceased. I believed that a violent eruption was likely to occur at any time, but many others insisted that Taal was dead, or as good as dead. In 1904 I began a series of photographs, which were added to at frequent intervals up to the time of the terrific explosion of January 30, 1911, and which now afford a basis for a study of the changes wrought in the crater not only by the 1911 eruption, but by the comparatively unimportant eruption of July 4-5, 1904, as well.

In April, 1904, a new funnel-shaped crater formed near the base of the southeastern portion of the inner main crater wall. Until July it continually emitted great masses of vapor and intermittently ejected mud and rocks. This unusual activity culminated, on July 4 and 5, in a sharp eruption, which I was fortunate enough to witness, having reached the shore of Volcano Island with a party from the Bureau of Science in the

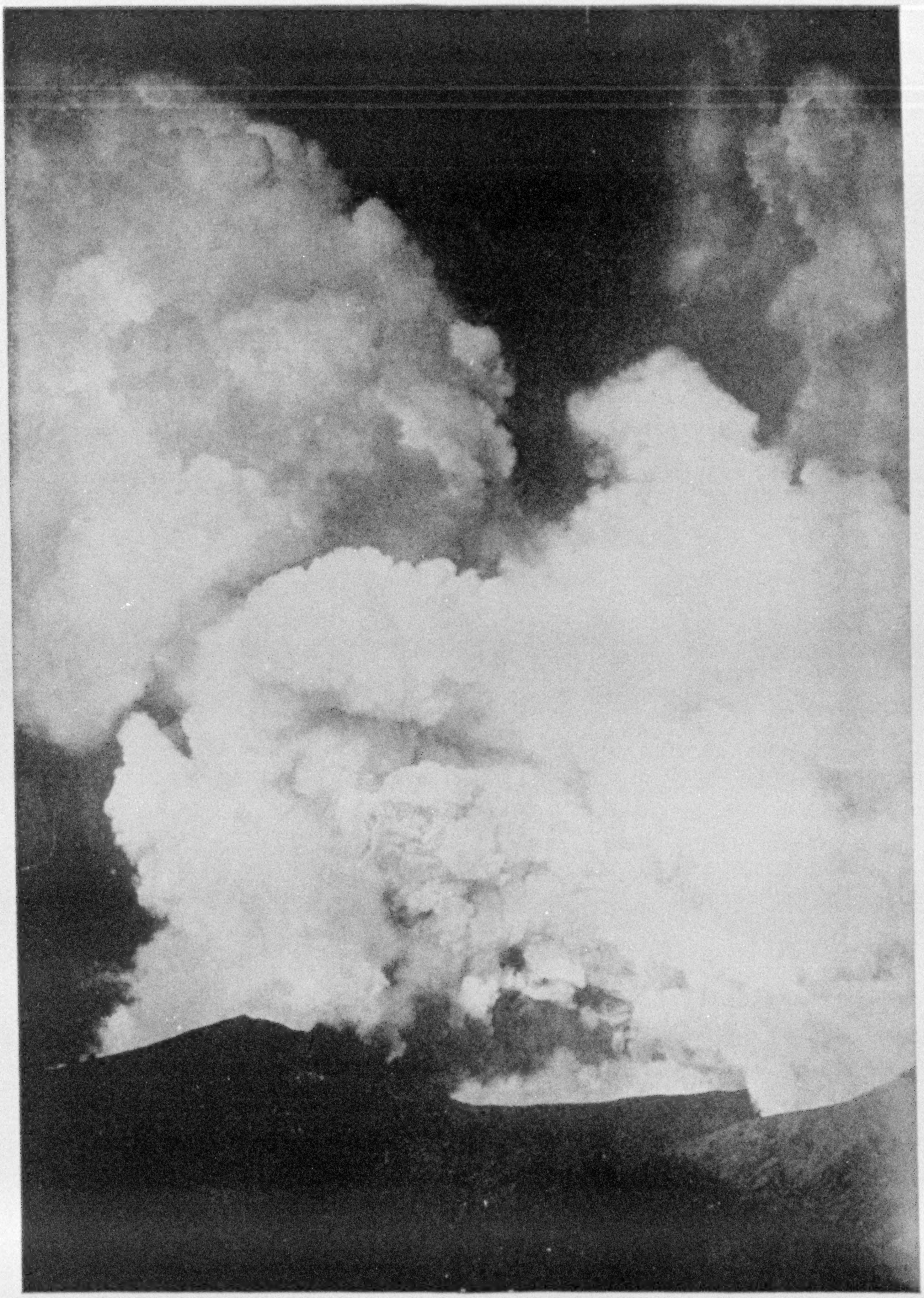

Photo by Charles Martin

AN EXPLOSION IN THE MAIN CRATER OF TAAL THE DAY BEFORE THE GREAT ERUPTION
This unusual photograph is a splendid tribute to the photographer's courage

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midst of a violent wind and rain storm on the evening of the former day.

We found the ascent of the volcano somewhat difficult, as its upper slopes were covered with recently ejected slippery mud. We struggled through this, reaching the crater rim at dusk and being rewarded for our efforts by a magnificent display. An enormous column of steam was rushing from the new funnel-shaped crater (see pages 323-4), and was illuminated by constant lightning flashes.

At frequent intervals there were explosions, which caused the ground to tremble violently, and huge boulders were hurled skyward. As there was little wind at the time, most of these fell back into the crater and rolled to the bottom, where they often momentarily plugged the steam vent, with the result that they were promptly blown into the air again. In fact, ascending boulders not infrequently passed descending boulders in mid-air.

Now and then enormous columns of black mud rushed upward to a height of 600 feet or more.

Long after dark we made our way back to the shore, where with some trepidation we established our camp for the night. Before morning there occurred an explosion so violent as almost to throw us from our cots.

The following day was spent in observing the magnificent display, and in an effort to secure photographs, which was rendered comparatively fruitless by frequent rain-squalls. From time to time we were showered with mud, which burned viciously, not because it was hot, but because of the strong acid which it contained (see pages 324-6 and 350).

When I again visited the volcano, a few weeks later, the disturbance had entirely subsided, and on my next subsequent visit the newly formed crater had become converted into a lake, which ultimately dried up.

TAAL AGAIN WRATHY

Taal continued unusually quiet until January, 1911. During the night of the 27th of that month the seismographs at the Manila Observatory commenced to register frequent disturbances, which were at first of insignificant importance, but increased rapidly in frequency and intensity. The total recorded shocks on that day numbered 26. During the 28th there were recorded 217 distinct shocks, of which 135 were microseismic, while 10 were quite severe. The frequent and increasingly strong earthquakes caused much alarm at Manila, but the observatory staff was soon able to locate their epicenter in the region of Taal Volcano and to assure the public that Manila was in no danger, as Taal is distant from it some 37 miles.

Definite news that Taal was in eruption was received during the morning of January 28, in a telegram to the Director of the Bureau of Science from Mr. J. D. Ward, who conducts tourists to the volcano. Mr. Charles Martin, the government photographer, left for the scene of disturbance at 3 p. m., reaching the edge of Bombon Lake at 8 p. m. Meanwhile various other telegrams had been received at Manila, stating that a huge column of black "smoke" had been pouring out of the crater since early morning, and that sinister subterranean rumblings were causing panic among the people of the neighboring towns.

THE BRAVERY OF PHOTOGRAPHER MARTIN

As Mr. Martin was one of the few competent observers who witnessed the eruption at short range, and who was not so overcome by the awful catastrophe in which it culminated as to be unable to give any intelligent account of what occurred, particular interest attaches to his statements.

He had been sent to obtain a photographic record of the phenomena of this eruption, which no one anticipated would be destructive, and he proceeded to perform his appointed task with extraordinary coolness, and with complete disregard for his personal safety. It is due to the merest chance that he is alive today.

Early in the morning of January 29 he crossed the disturbed waters of Bombon Lake in Mr. Ward's boat and by 8 o'clock had made his way to the crater rim, from which point he secured a mag-

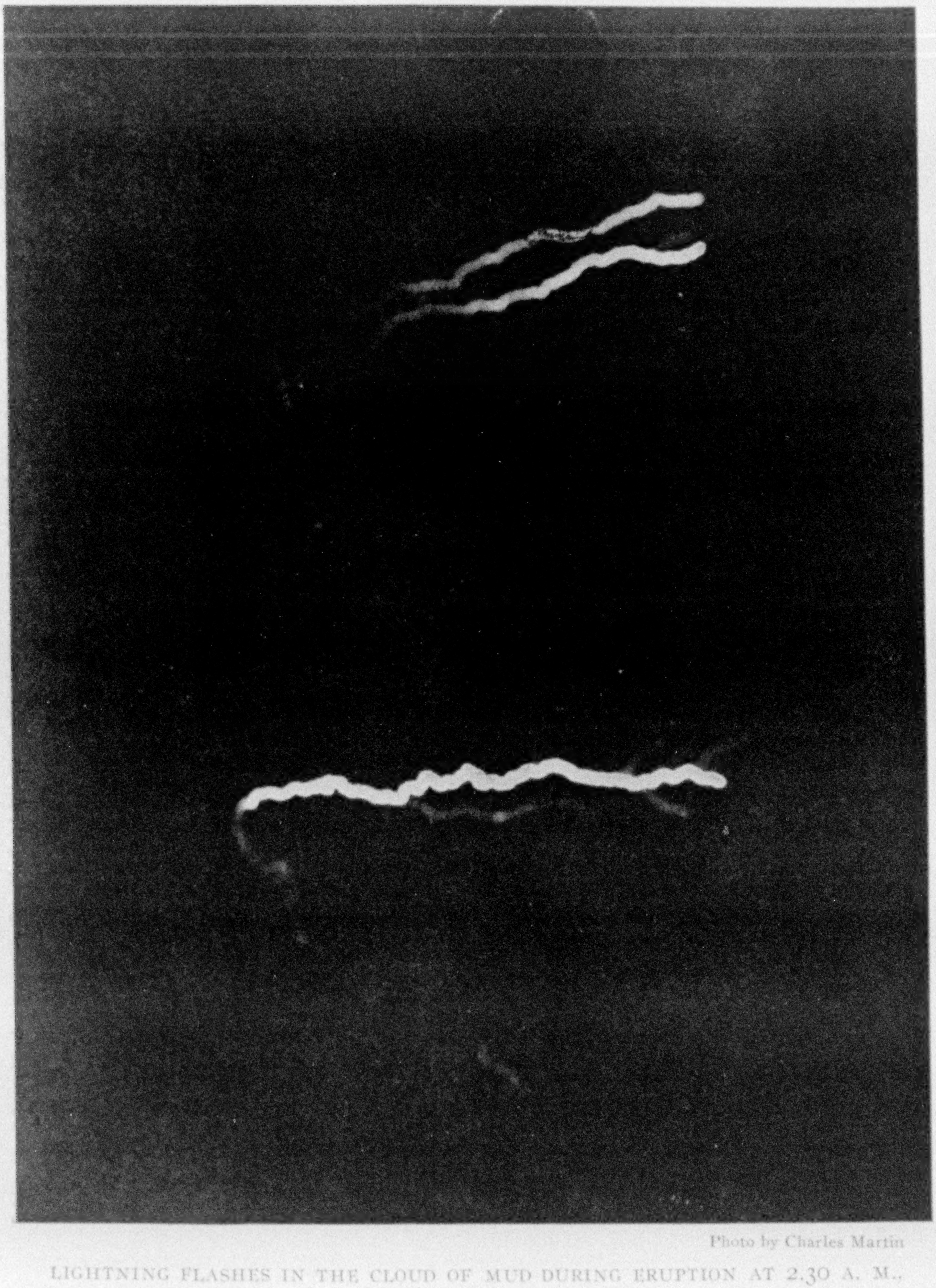

Photo by Charles Martin

LIGHTNING FLASHES IN THE CLOUD OF MUD DURING ERUPTION AT 2.30 A. M., JANUARY 30, PHOTOGRAPHED AT A DISTANCE OF ABOUT FIVE MILES

The "streams" of electricity which flowed around the lofty column of ejecta thrown out by the great explosion were of extraordinary breadth (see pages 339, 343, and 345)

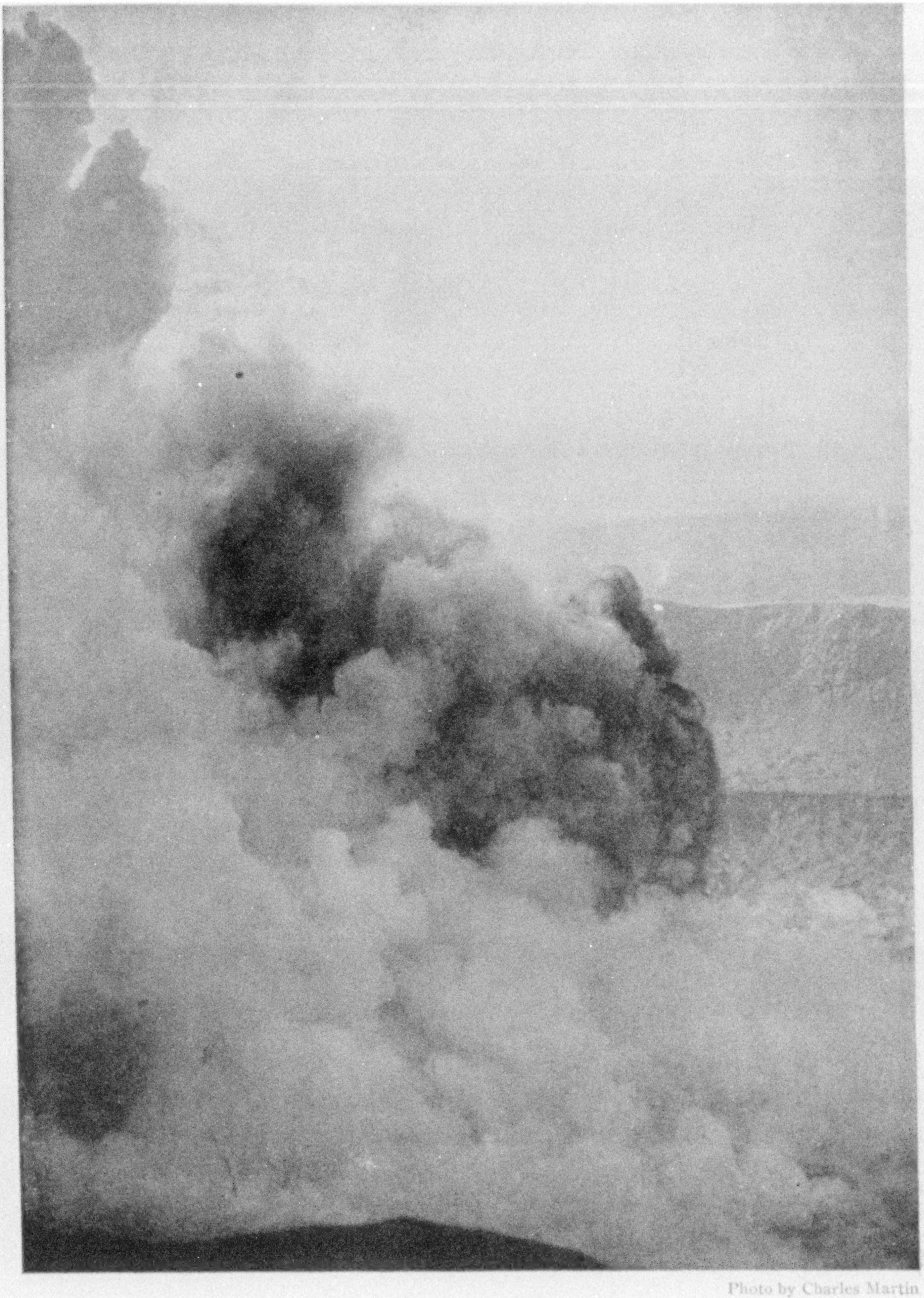

Photo by Charles Martin

A PORTION OF THE CRATER OF TAAL VOLCANO THE AFTERNOON AFTER THE GREAT ERUPTION

To the right may be seen a bit of the opening torn in the floor of the old crater by the explosion. This subsequently filled with water, which ran in from Bombon Lake through the crater walls (see page 346).

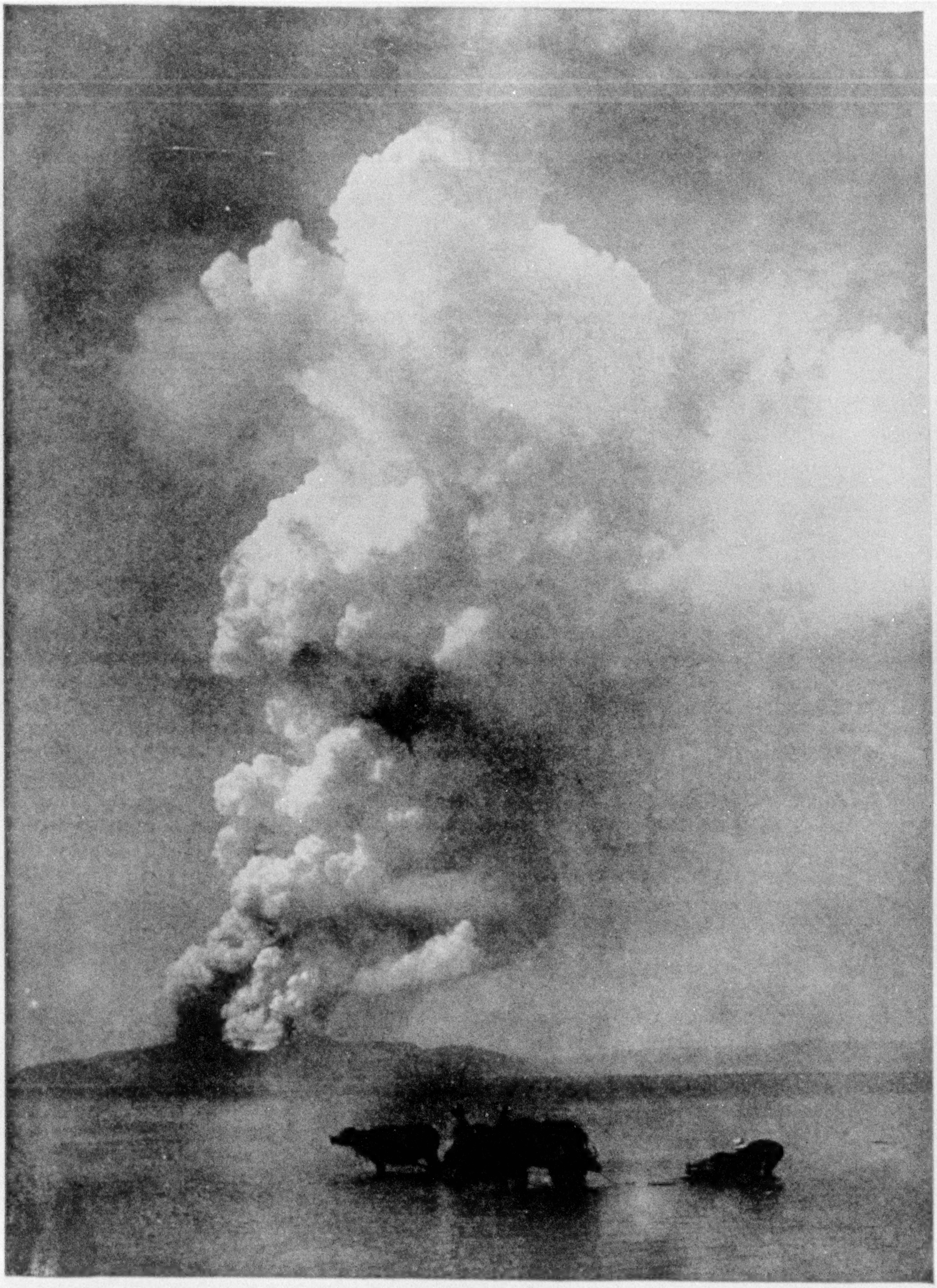

Photo by Charles Martin

TAAL VOLCANO FROM BAÑADERO THE MORNING AFTER THE GREAT ERUPTION: NOTE AT THE LEFT THE BLACK MUD BELCHING FROM THE CRATER

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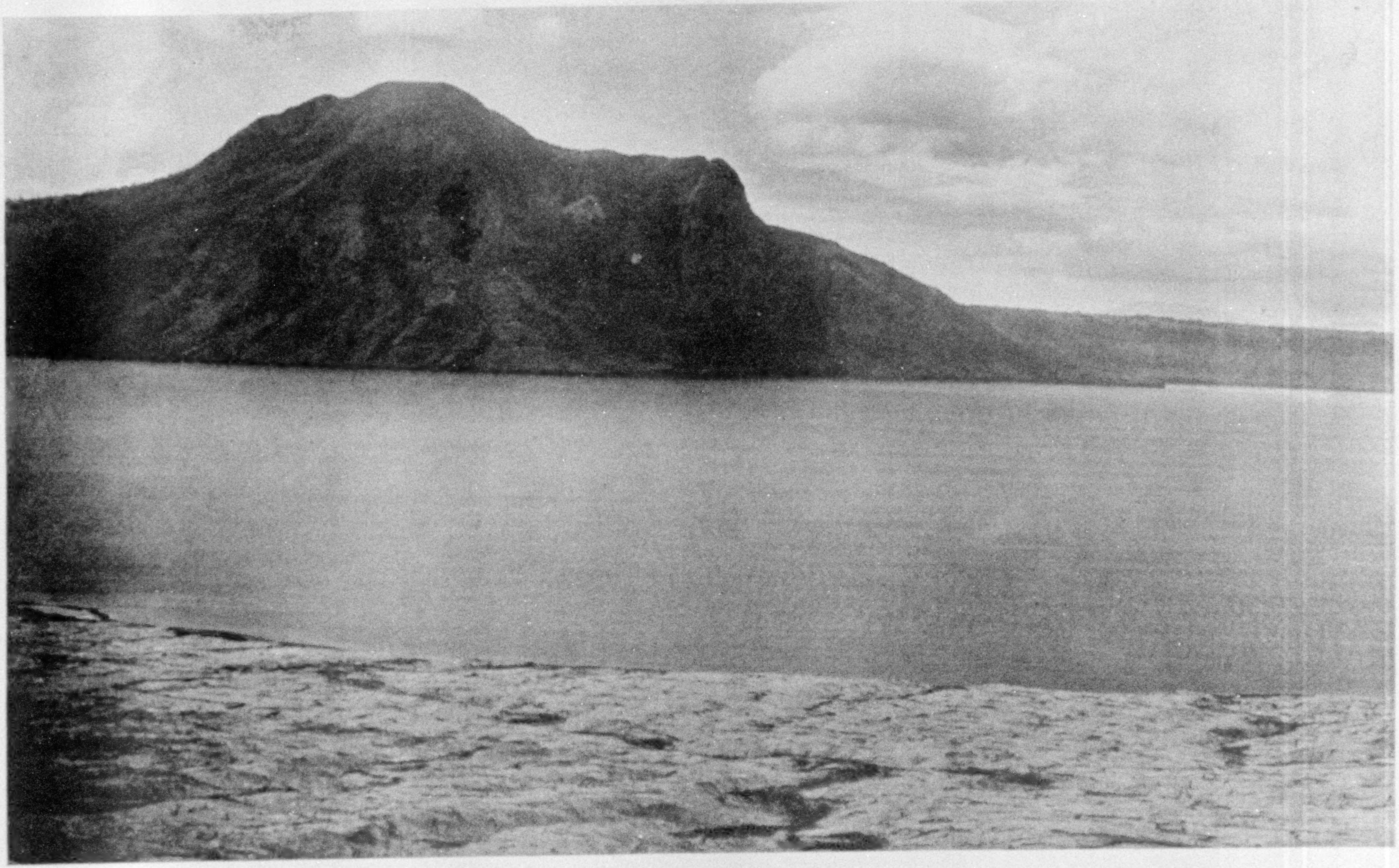

Photo by Charles Martin

MOUNT MACOLOD, FROM WHICH SOME OF THE PEOPLE OF BATANGAS VIEWED TAAL VOLCANO THE DAY BEFORE THE ERUPTION

Note that the shore of Volcano Island, showing in the foreground, has been swept absolutely bare of vegetation by the great explosion. (See pages 328, 329, and 356.) Mount Macolod is by some believed to be a fragment of the great volcano which formerly covered the area now occupied by Taal and by Lake Bombon, which surrounds it. Others consider it an independent volcanic peak.

nificent series of photographs giving an impressive idea of the play of titanic forces which was then occurring (see pages 330 and 333).

It was at once evident that every weak point in the crater floor had given way. From the former site of the green lake, at one end of which was located the active crater in 1888, there rolled an enormous column of vapor, which towered skyward unil caught by the morning breeze, and was then swept, black and threatening, westward over the neighboring province of Cavite. The 1904 crater, which had long been choked with mud and stones, was again in full activity, and a small new crater had formed to the north at a point where the long-continued existence of a large solfatara had led us to anticipate that there would be a break in the event of an important eruption.

From the central and more important of these three openings enormous masses of black mud were thrown to a great height at frequent intervals, boring their way through the column of white steam. There were frequent loud explosions of sufficient intensity to shake the solid earth.

The varied phases of this imposing display tempted Mr. Martin to expose plates until his stock became practically exhausted, when he returned to Tanauan with but a single plate ready for use.

THE TERRIFIC EXPLOSION

At 1:05 on the following morning he was awakened by an extraordinarily heavy explosion and saw an enormous column of mud rising from the crater, which was distant some 11 miles. There was a magnificent display of "chain" lightning about the black mud cloud, and the explosion had awakened and terrified every one. Twelve minutes later there was a rain of mud at Tanauan. It was followed by a fall of fine, dry volcanic ejecta. Shortly before 2 o'clock the sky, which had been obscured by the black mud cloud, cleared completely.

While Mr. Martin and his companions were still discussing the imposing phenomenon which they had witnessed, there occurred at 2:20 two terrific explosions, or I should perhaps say a double explosion, for the second report succeeded the first so quickly as almost to coincide with it, and people a little further away noted but one concussion. We now know that this explosion tore most of the floor out of the main crater of Taal Volcano and hurled it skyward. A huge black cloud continued to rise for a long time. Its ejection was attended by a most extraordinary electrical display, which was visible for 250 miles.

The explosion was heard over an area more than 600 miles in diameter. In the subprovince of Kalinga the wild men thought that the dynamite stored at Lubuagan by the government for use in road construction had exploded, and throughout the following day delegations from various settlements visited the town to ask the lieutenant governor if this was the case.

Mr. Martin says that the cloud at first rose steadily, but "soon the wind got hold of it and it spread out all over the country, leaving us in total darkness. Wet mud started to come down in Tanauan about 12 minutes after the explosion and kept on falling for not less than half an hour, until it covered the ground."

A WONDERFUL ELECTRICAL DISPLAY

In Manila the shock of the explosion was so great that people leaped from their beds in terror, thinking that there had been some great catastrophe in the city. Their attention was instantly attracted by the glare of the electrical display, and many of them realized that Taal must be in full eruption. The thousands who witnessed the extraordinary sight agree that it beggared description, and few of them have even attempted to describe it. The streams of electric fluid seemed to be of extraordinary breadth.

With the instinct of the photographer still alert, Mr. Martin exposed his one remaining plate; but, unfortunately, in the excitement of the moment he failed to realize that a flash of lightning makes its own exposure; and, fearing that the steady glare resulting from the myriad discharges would fog his plate, timed his shutter to one six-hundredth of a second, with the result here reproduced.

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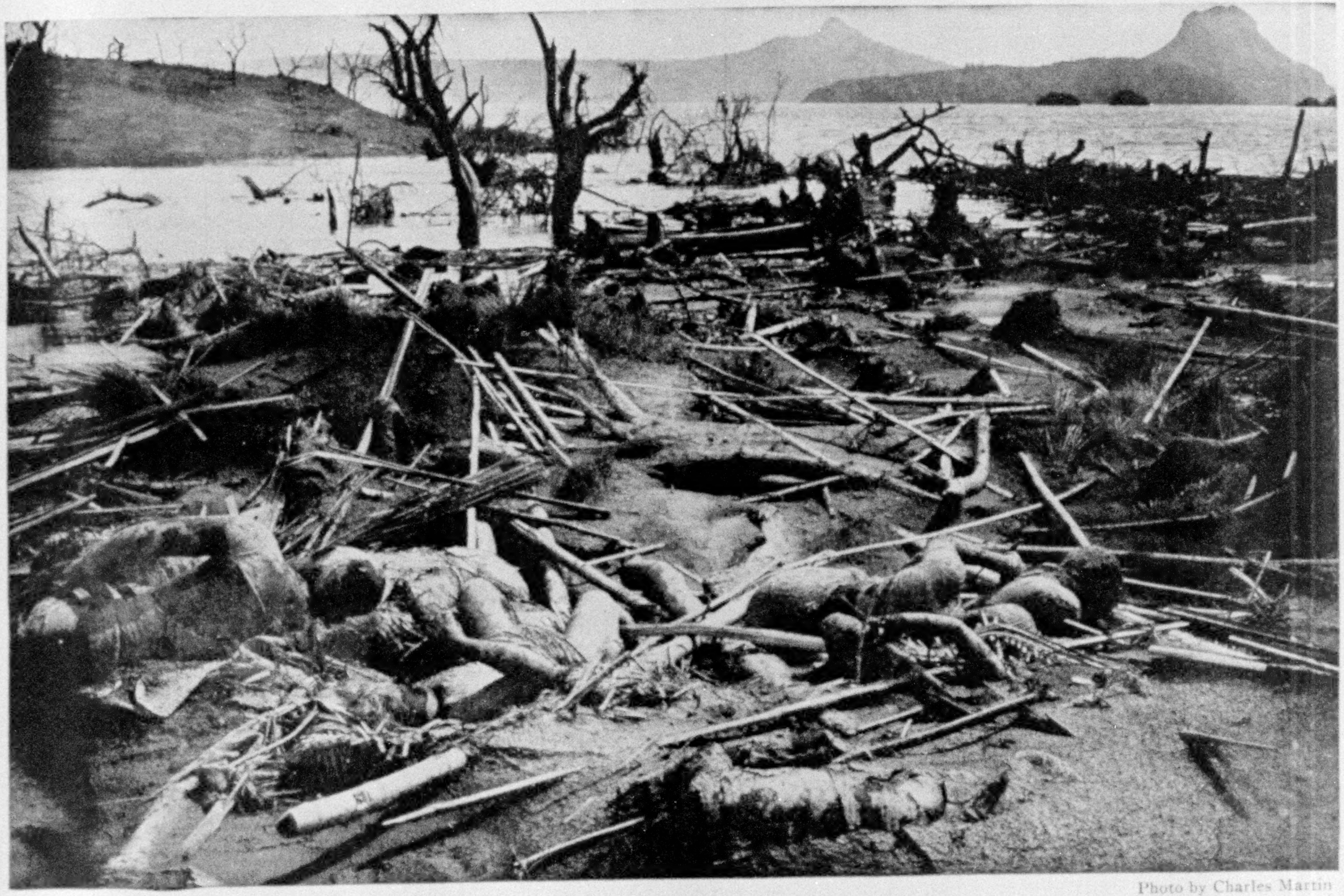


Photo by Charles Martin

DEATH AND DESTRUCTION

Scene on Volcano Island, January 31, 1911, the day after the great eruption (see page 345)

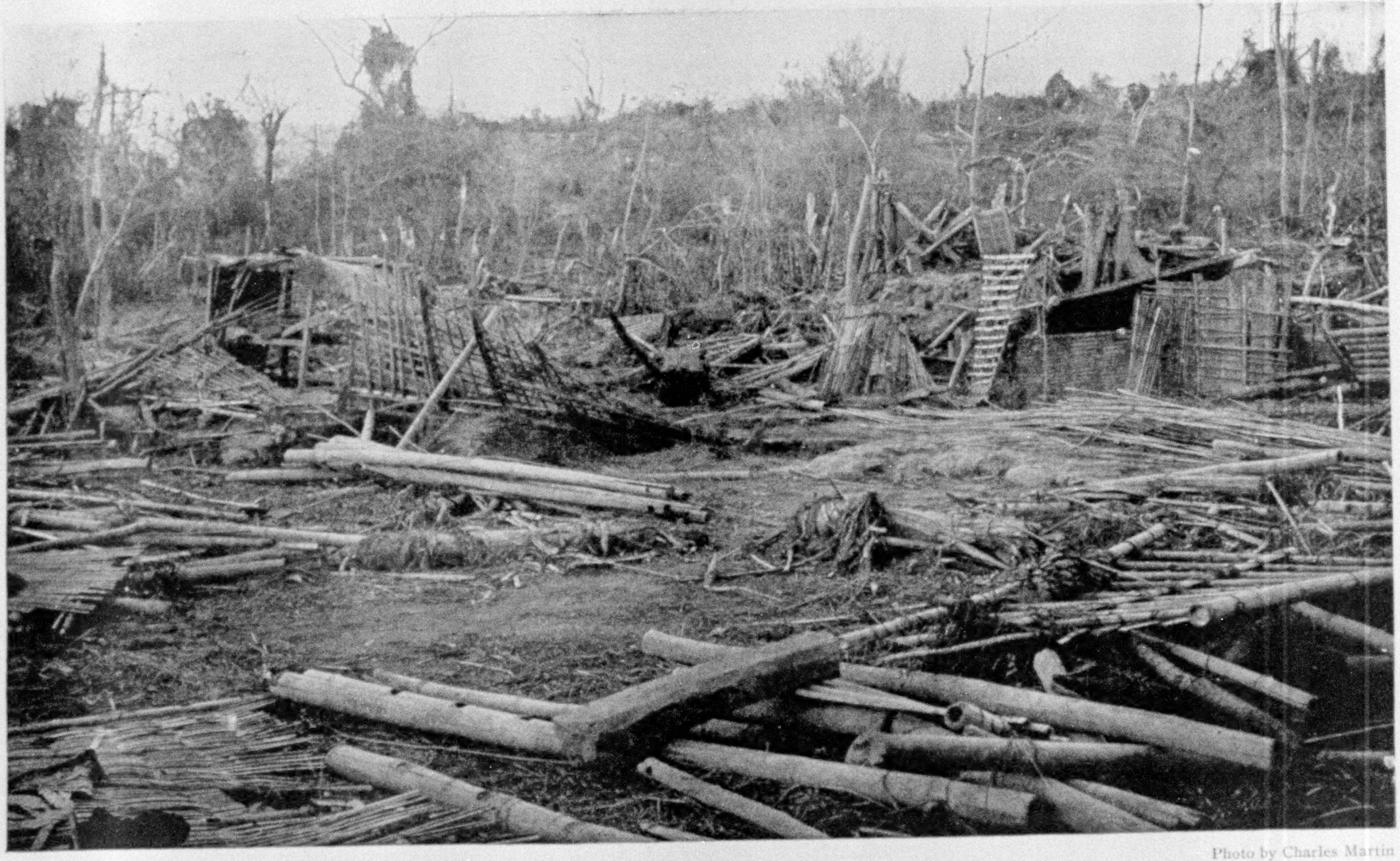


Photo by Charles Martin

REMNANTS OF THE VILLAGE OF SUBIG, IN THE ZONE OF PARTIAL DESTRUCTION

The chief damage in this village was caused by a great wave which swept inland from Bombon Lake

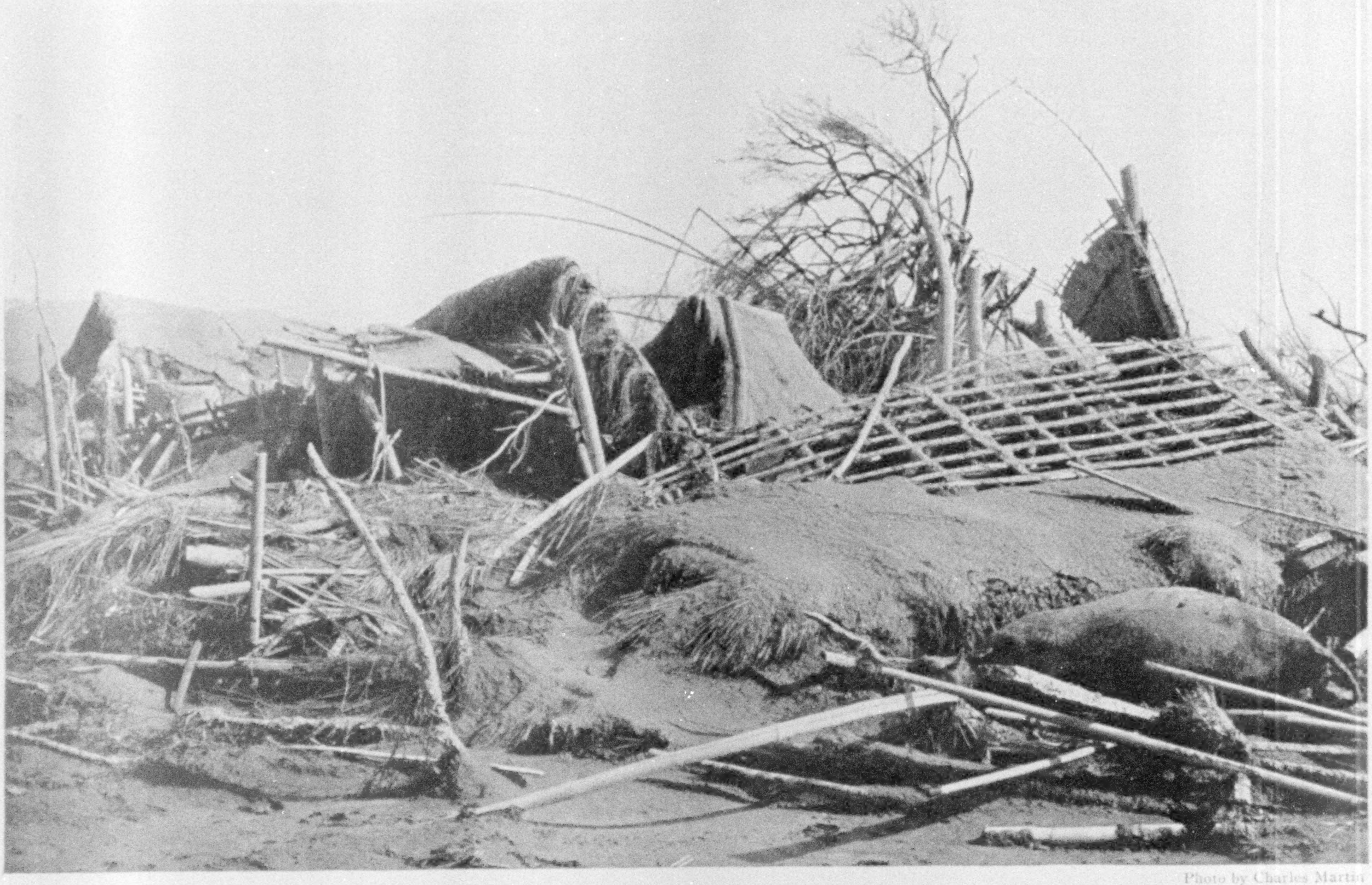


Photo by Charles Martin

RUINS AT BOSOBOSO (SEE PAGE 314)

Out of 150 people said to have lived in this village, 130 were killed outright

When it is remembered that these flashes were taken at a distance of some five miles through a lens with a focal length of 300 millimeters, and that the photograph is here reproduced exactly as far as regards size, some idea will be gained of the breadth of the discharges (see picture on page 335).

Father José Algué, director of the observatory at Manila, also attempted to photograph the flashes with some success, but only those who witnessed the imposing phenomenon will ever have any adequate idea of its magnitude. Some idea of the height of the column of ejecta may be gained from the fact that the electrical display about it was plainly visible 250 miles away.

Apart from the flashes, there were "globes of fire," which rose and fell in graceful curves.

Father Algué, who is a close scientific observer, has sent to the Royal Meteorological Society an account of the eruption, from which I quote the following:

"The electrical display which accompanied the eruption added greatly to the terrors of the phenomenon. As seen from Manila, at a distance of 63 kilometers from the volcano, it had the appearance of an unusually violent thunder-storm, except that there were no clouds, the brightest stars being visible through rifts in the huge black masses of smoke, ashes, and mud. During the period of greatest electric activity, which was from $2^h\ 30^m$ to $2^h\ 50^m$ a. m., I tried to secure some photographs of the phenomenon, but during a five minutes' exposure, at $2^h\ 40^m\ 45^s$, only the flashes of lightning made any impression on the plate, which seems to show that the light emitted by the globes of fire was of low activity. Some of the flashes recorded appear at an angular distance of about 13° above the horizon and 17° from the crater (toward west), which would seem to indicate that electric discharges took place up to a height of nearly 15 kilometers above the earth and at least 19 kilometers in a slanting direction (toward west) of the crater."

THE EXPERIENCES OF MR. MUNI

Mr. George J. Muni, the provincial treasurer of Batangas, who was at the provincial capital during the eruption, has given an interesting account of his observations at that place, which is distant some 14 miles from the crater. He says that the first earthquakes were felt shortly after 9 p. m. on January 27, becoming much more severe at 11 p. m., and that by midnight sleep was impossible. By 3 a. m. many of the residents had deemed it advisable to leave their houses and camp in open places. During the 28th the earthquakes were so frequent and severe that all government buildings and large houses of heavy materials were vacated. The ground trembled constantly and steam rose from the volcano in a steady cloud. He continues:

"On Sunday morning, January 29, we were beginning to feel the effects of this trying and unusual experience and the loss of sleep; so, to divert our minds and to obtain a good view of the volcano, a number of us went by *carromata* to the town of Cuenca and climbed the west shoulder of Mount Macolod. From this elevation, which was considerably above the volcano, we could see into the crater, as it is located at the end of the island in Lake Taal, nearest Mount Macolod.

"We spent about three hours on the mountain observing the volcano, and noticed that after each earthquake a volume of steam would belch forth from the crater. During severe shocks we could see the mountain on which we were move and rock. The volcano on the whole seemed to be much quieter than the previous day, and upon our return to Batangas in the late afternoon we decided to try sleeping indoors again.

"We retired early, worn out from the two previous nights' loss of sleep and our trip, and slept soundly for an hour or two. We were then awakened, however, by a severe shock and could not again sleep, as the quakes became more frequent and heavy, so that shortly after midnight my wife and I decided to again vacate the house, and had cots taken out to the grounds of the government building. We did not sleep, but lay with our faces towards the volcano.

"Suddenly, shortly after 1:00 a. m., we saw flashes of light, felt a severe shock, and heard a loud rumble. Then a thick, black, balloon-shaped cloud arose

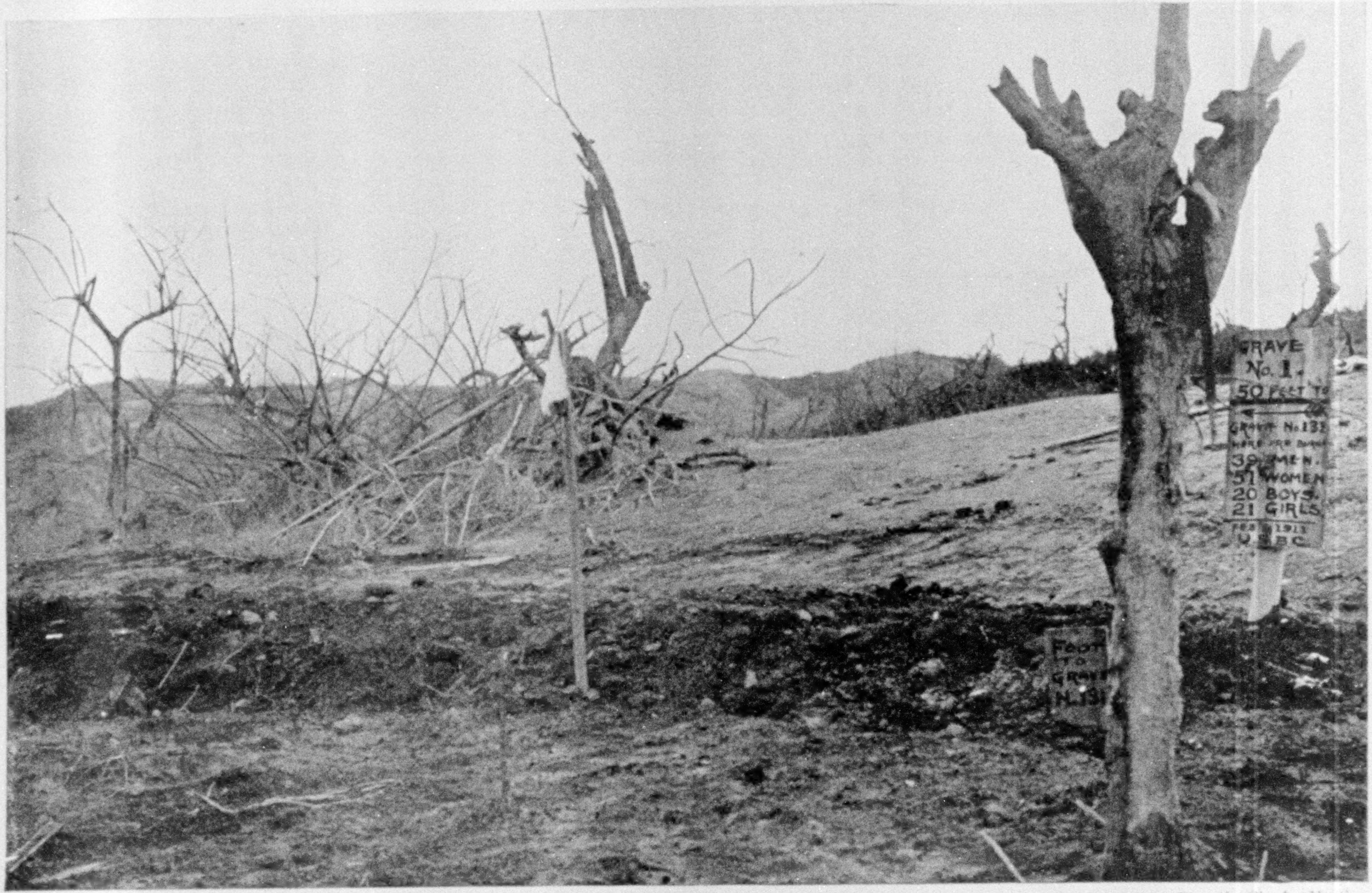

GRAVE
No. 1.
50 FEET TO
GRAVE No. 131
39 MEN.
51 WOMEN
20 BOYS.
21 GIRLS.
U S B C
FOOT
TO
GRAVE
N. 131

Photo by Charles Martin

GRAVE IN WHICH WERE BURIED 131 VICTIMS OF THE ERUPTION: NOTE HOW THE TREES HAVE BEEN DEVASTATED AND EVERY TRACE OF THE LUXURIANT VEGETATION OBLITERATED

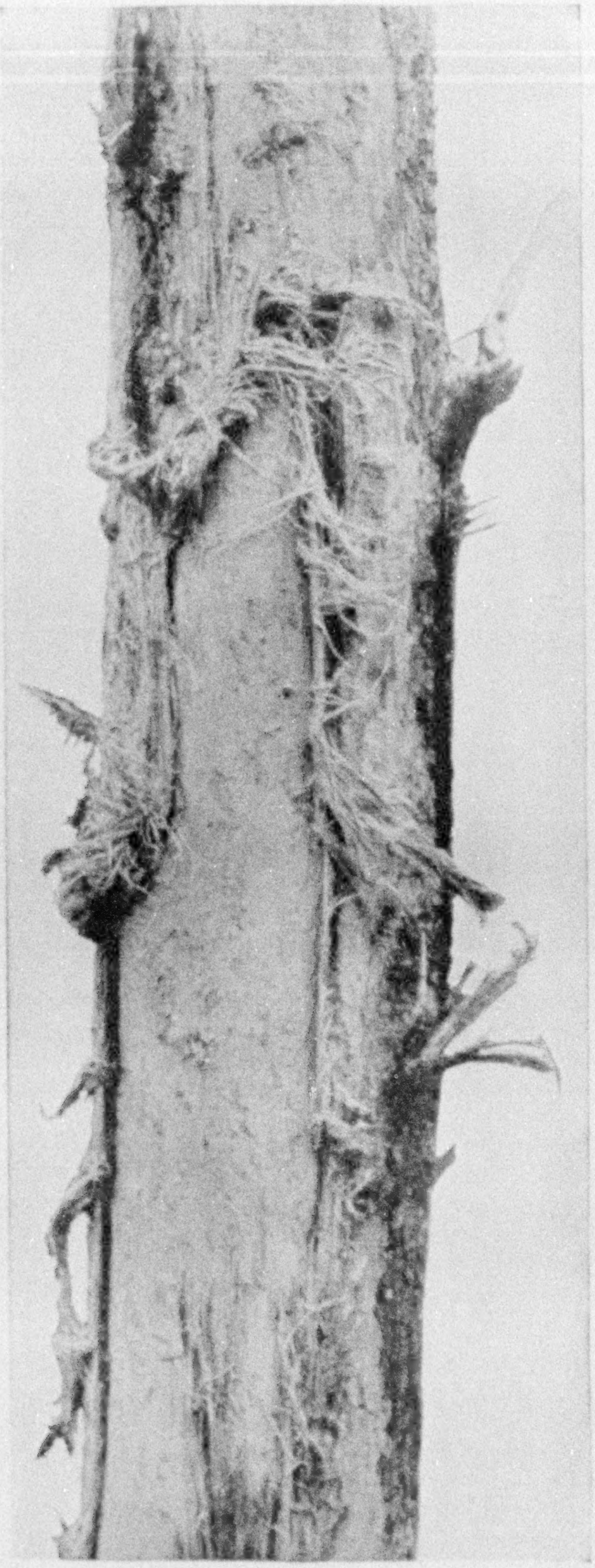


Photo by Charles Martin

PORTION OF A TREE TRUNK WITH BARK CUT TO PIECES BY THE BLAST FROM THE VOLCANO

Note that the bark is not burned

from the crater and hung over it, and was illuminated by sharp flashes and streaks of lightning. This lasted about five minutes, when the wind dispersed the cloud and the flashes of lightning ceased.

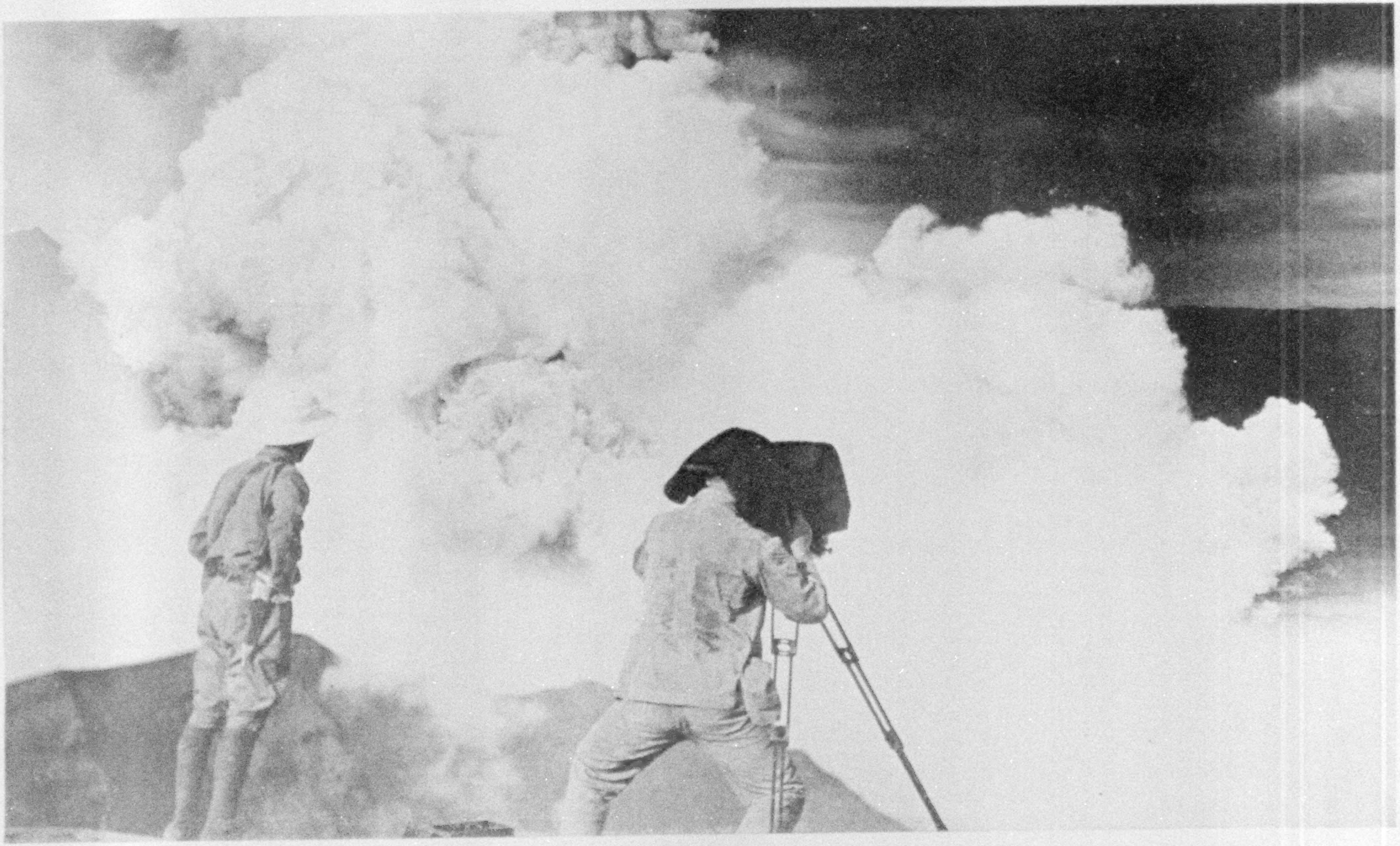
"The earthquakes from then on seemed to be more violent until, at about 2:20 a. m., a great explosion occurred, and we saw balls of fire shoot up above the crater and an immense column of smoke and ashes arose and formed a great cloud, which appeared to be several miles in height. This was lighted up by a very vivid electrical display and accompanied by long, heavy rumblings, all of which lasted about 15 or 20 minutes. Then the wind blew the cloud of smoke and ashes in a northeasterly direction, towards Tanauan, and the smoke continued to pour forth from the crater for many hours. No further eruption was witnessed.

"The severity of this explosion drove most everybody out of their houses and created great excitement, and most of the people walked the streets or stayed in the plaza until morning, wondering what would happen next."

THE AWFUL SLAUGHTER OF FILIPINOS

The thousands upon thousands of people who were awakened by the final explosion in time to see the enormous column of ejecta shooting up from Taal, and to witness the extraordinary attendant electrical display, little dreamed that in the twinkling of an eye some 1,400 human beings had perished. Indeed, a period of several days elapsed before it was realized at Manila that an appalling calamity had occurred. This was largely due to the fact that there was a sharply marked zone of devastation, within which the destruction of life and property was practically complete, while outside of this region comparatively little harm was done. It is a gruesomely significant fact that the known killed numbered 1,335, while the known wounded, many of whom were terribly injured, and not a few of whom subsequently died, numbered only 199.

The fall of mud was deep enough over the area of complete destruction to render travel excessively difficult, and the



SCIENTISTS UNDER FIRE

Government Photographer Charles Martin and Geologist Wallace E. Pratt, both of the Philippine Bureau of Science, on the edge of the crater of Taal Volcano on the day of the great eruption. Mr. Martin at this time secured many of the photographs illustrating the present article. Fifteen minutes after these young men left Volcano Island there occurred a tremendous explosion, sending forth a cloud of mud and fumes which rolled down the slopes of the volcano, enveloping the island completely (see pages 348 and 355) vegetation, broken and tangled by the fierce blast from the volcano, still further impeded progress. Communication by water along the lake shore continued for some time to be hazardous in the extreme. The only launch on the lake was driven inland by a huge wage and badly injured. Many of the small native boats were destroyed.

The cloud of ejecta was seen to drift towards Tanauan and Santo Tomás, and it was believed that these places would suffer most severely. They were immediately communicated with and reported a heavy fall of "ashes," which had seriously damaged crops but had caused no casualties among the people. Taal and Lemery also reported that no important damage had been done.

The stranded launch was put into commission, although still in a partially disabled state, the afternoon after the eruption, and in it Mr. Martin and others proceeded to Volcano Island, where they found, as had been anticipated, that the devastation had been complete.

THE HEROISM OF SCHOOLMASTER BUCK

Meanwhile Mr. H. H. Buck, the division superintendent of schools of Batangas, made his way to the west shore of the lake, fearing for the safety of the people there. As promptly as possible, after discovering the terrible truth, he pushed through to a point from which communication could be had with Manila and sent a laconic telegram, reading as follows:

"Have visited barrios on west-side lake. Five totally destroyed. Loss of life not less than three hundred. Many burned. Houses destroyed. Need funds. Calamity."

This telegram, received at Manila at 7.55 p. m. on the day of the eruption, embodied the first intimation that there had been loss of life and served to set the wheels moving.

Let no one think that it was a pleasure trip that this young man took across Bombon Lake. The volcano was still terrifyingly active and no one knew when there might be another death-dealing explosion. No less than 88 earthquakes, having their origin in the volcano, were recorded during that day at Manila. Ten of them were quite severe, and all were, of course, far more strongly felt on Volcano Island and on the shores of Bombon Lake than at a point 39 miles distant.

The waters of the lake were constantly disturbed by the movements of the earth, and were liable at any moment to rise in overwhelming waves like those which had swept away whole villages in the early morning.

But this school teacher coolly set sail in a frail native craft and proceeded to visit the area which the volcano, still in eruption, had just devastated, and when he left took away with him not only reliable information as to the conditions there, but eleven badly wounded survivors and the bodies of many of the dead.

How often it is true that a great emergency calls forth from the common crowd a man ready and able to meet it. The *only* man who realized and met the emergency in this sorely stricken region on that dreadful day was H. H. Buck.

The American treasurer of Batangas, Mr. Muni, was in Manila when Mr. Buck's telegram was received. He hurried back to his province overland and inaugurated effective relief measures immediately upon his arrival, working unremittingly until the crisis had passed.

As speedily as possible launches were dispatched from Manila with a detachment of the U. S. Army Burial Corps under command of Captain Metcalf. There were also sent a physician, a motor boat for use on the lake, and medical and commissary supplies. Colonel Kingsbury, in command at Camp McGrath, promptly ordered Dr. Kennedy to Taal and later had many of the wounded cared for at the post hospital. Other doctors were rushed to the scene at once. There were immediately established a dressing station at San Nicolas, on Bombon Lake, and a receiving station at Taal. From Taal the wounded were sent to the Army hospital at Camp McGrath or to the Philippine general hospital at Manila.

Captain Metcalf and his men pushed

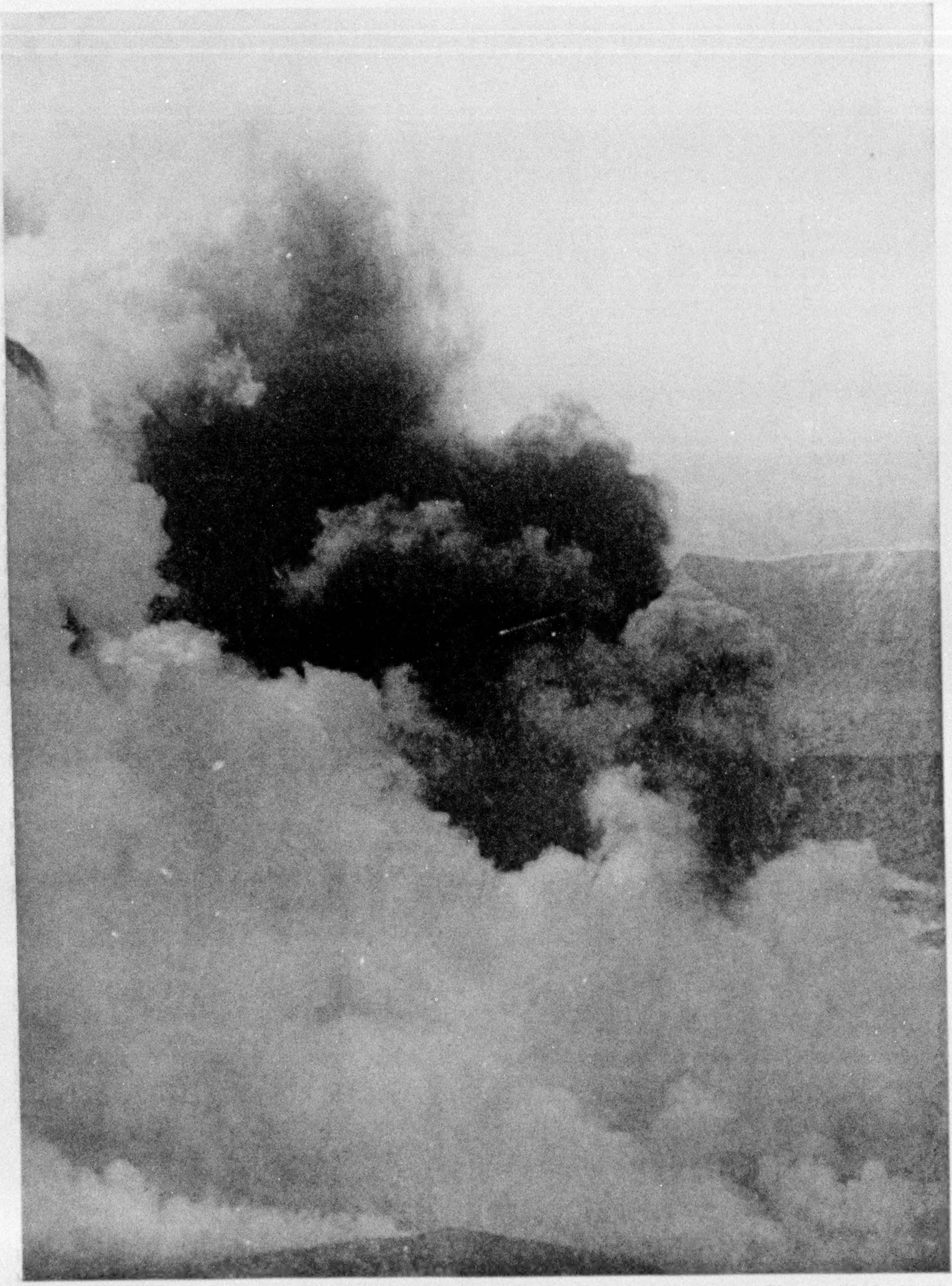


Photo by Charles Martin

MUD BLAST FROM THE CRATER OF TAAL VOLCANO

This photograph was taken by Charles Martin the afternoon following the great eruption (see pages 346 and 355)

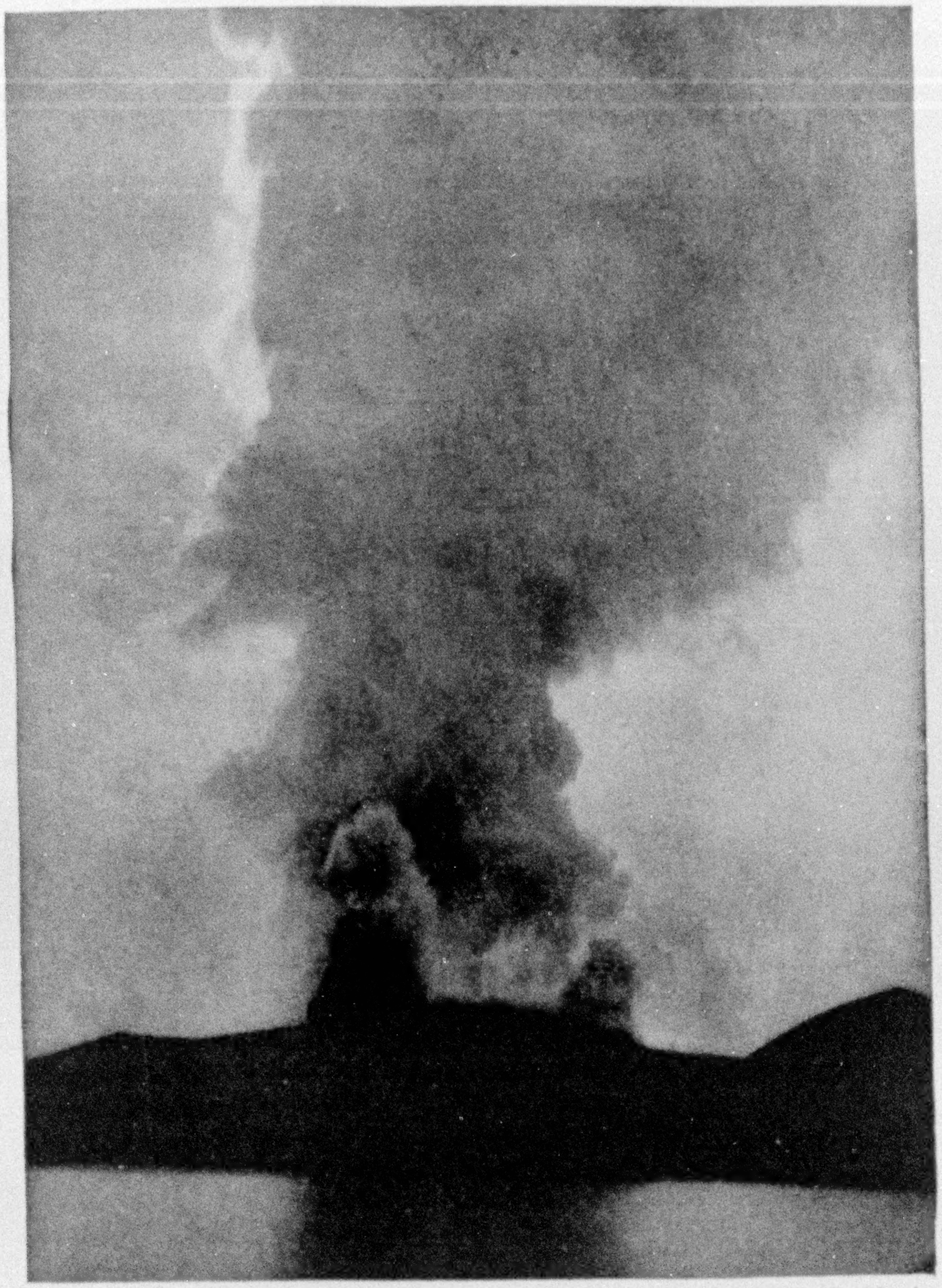


Photo by Charles Martin

THE BEGINNING OF THE EXPLOSION ON THE AFTERNOON OF THE DAY OF THE GREAT ERUPTION

through to the lake shore with all possible speed. They could not obtain boatmen or even paddles, but taking possession of a leaky old dugout, and using their shovels for paddles, they embarked on the troubled waters of the lake, reached the devastated area, and began their gruesome but necessary task.

The force of Philippines constabulary, which was camped near the lake at the time of the eruption, was promptly added to and rendered effective service in maintaining order and assisting the panic-stricken people. Promptly upon request, officers and men of the U. S. Army Signal Corps opened up communication with the devastated area by means of field wireless apparatus and of quickly constructed telephone and telegraph lines.

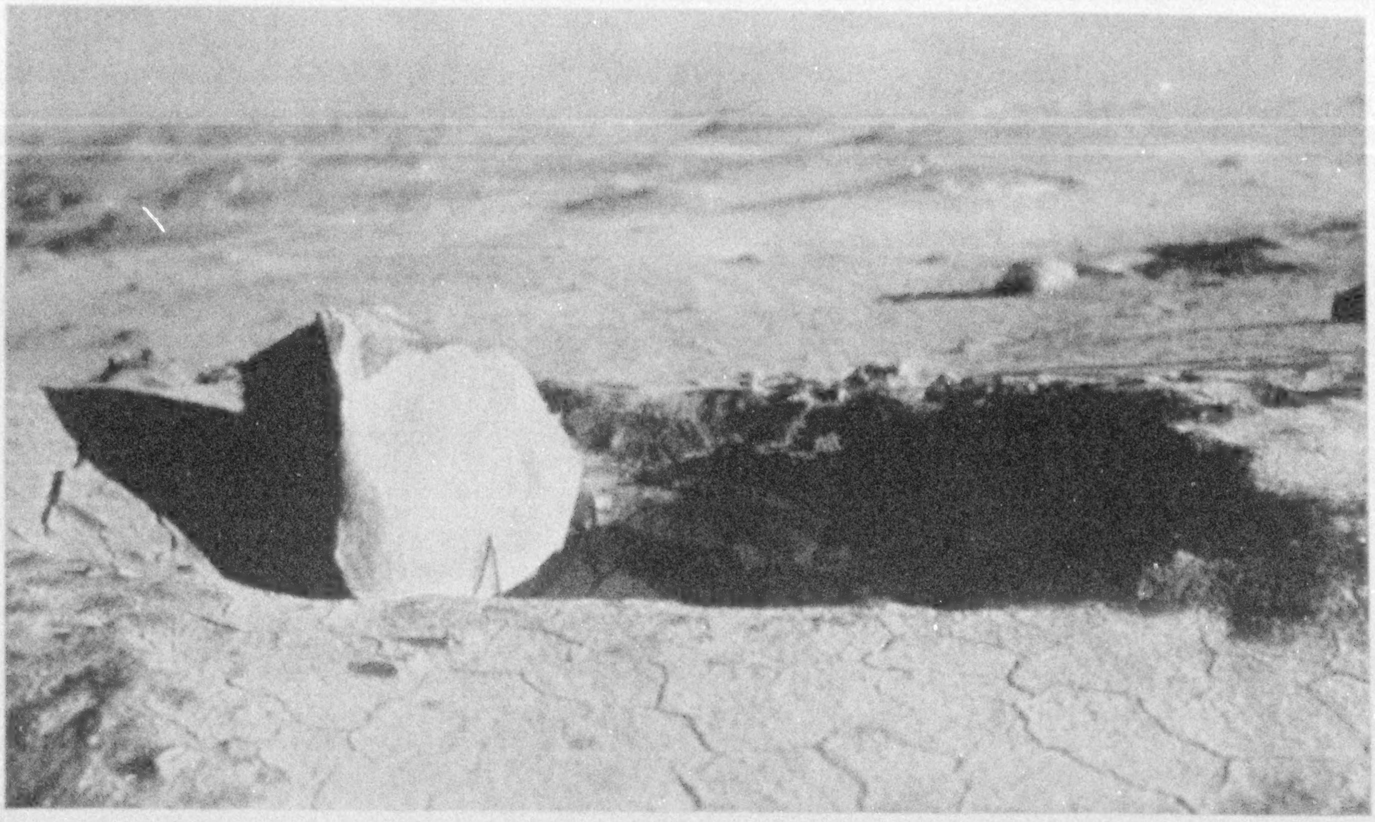


Photo by Charles Martin

A BOMB

Note the pit in the mud made by this rock when it fell. Few rocks of any great size were ejected from the crater during the eruption

THE FLESH WAS BURNED BY ACIDS

The dead and the wounded were found in most unexpected places. Not a few persons had been fleeing in terror as a result of the explosion which had occurred at 1:05 when overwhelmed by the final cataclysm at 2:20, and had meanwhile been able to travel a considerable distance from their homes. Many were washed inland by the waves from the lake and were buried under piles of débris.

Most of the survivors were horribly injured. In numerous instances their flesh was lacerated and their bones were fractured by stones from the volcano, falling timbers of houses, or flying débris driven by the dreadful blast from the crater, while most of them had horrible injuries the exact nature of which is in dispute. They have been almost invariably referred to as "burns," but the fact that clothing was not charred in any observed instance negatives the idea that the dead were killed, or the wounded injured, by fire.

It was noted, furthermore, that the bark of the stumps of trees on the side towards the volcano was often cut to tow, when not completely destroyed, and that the resulting fine strands of wood fiber were not burned, and in my opinion there is little doubt that a large majority of the killed and wounded were injured by what was in effect a gigantic sand blast. This view is strengthened by the fact that in many cases the thinnest and most transparent fabrics sufficed completely to protect the underlying flesh.

It has been stated that a large number of the victims were terribly scalded by hot mud. I doubt whether the mud was really *hot* enough to scald when it struck persons living at any considerable distance from the volcano, and believe that many of these burns were *chemical*, and were due to the fact that the mud was heavily charged with strong acid (see also page 334).

Chemical examination had long before demonstrated the fact that the waters of one of the crater lakes contained sulphuric acid in sufficient quantity promptly to attack the skin of one's hands. It was furthermore noted during this eruption that the thinnest coating of mud sufficed to kill green leaves and grass. The volcanic ejecta are still so strongly acid that it has proved impossible to raise crops where they have

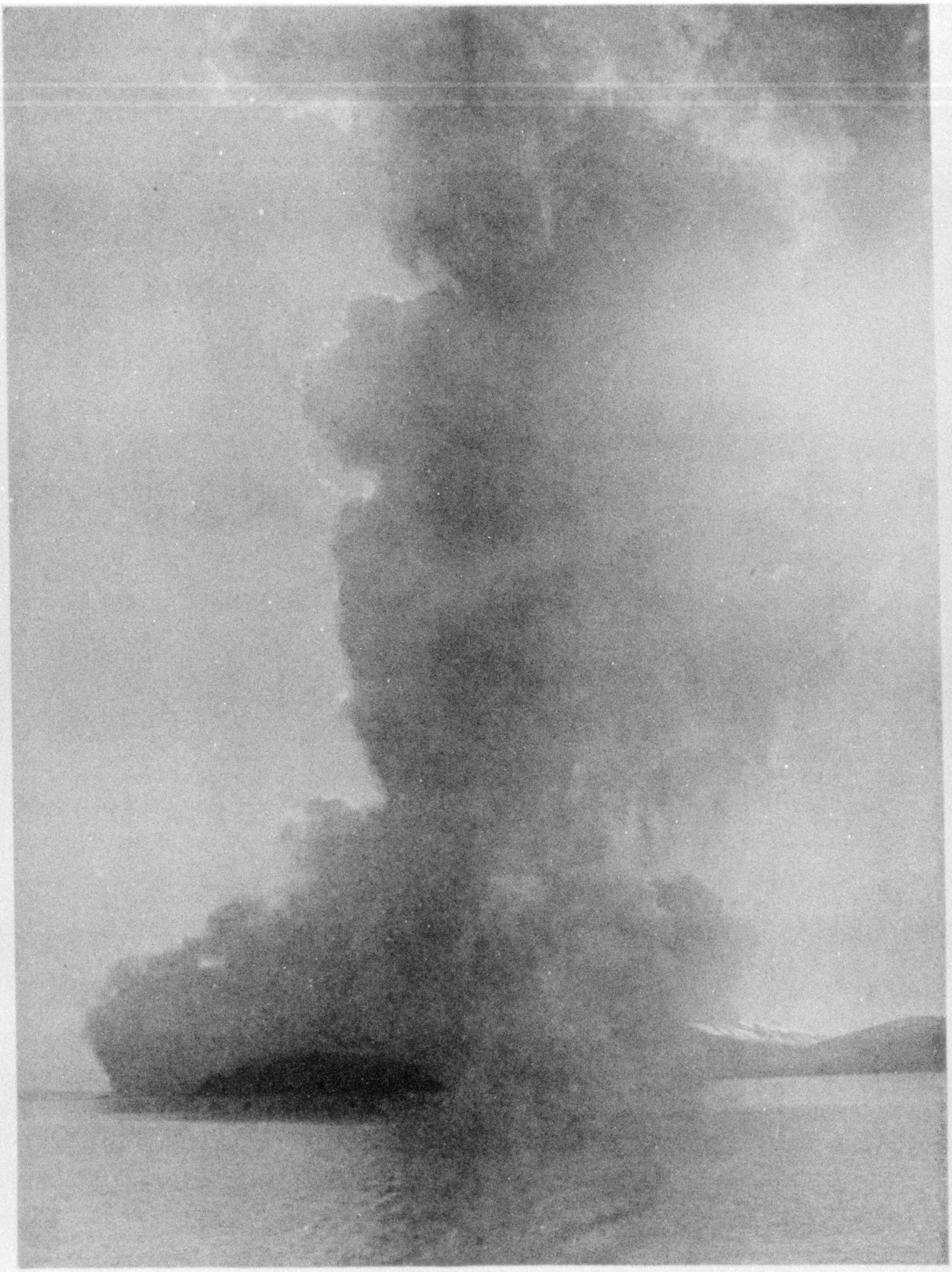


Photo by Charles Martin

THE EXPLOSION ON THE AFTERNOON OF THE DAY OF THE GREAT ERUPTION

A heavy cloud of fumes settled down over the island, completely enveloping it. This photograph shows the gases actually settling. The government photographer had just left the island. A few minutes' delay would probably have cost him his life (see page 346).

XUM

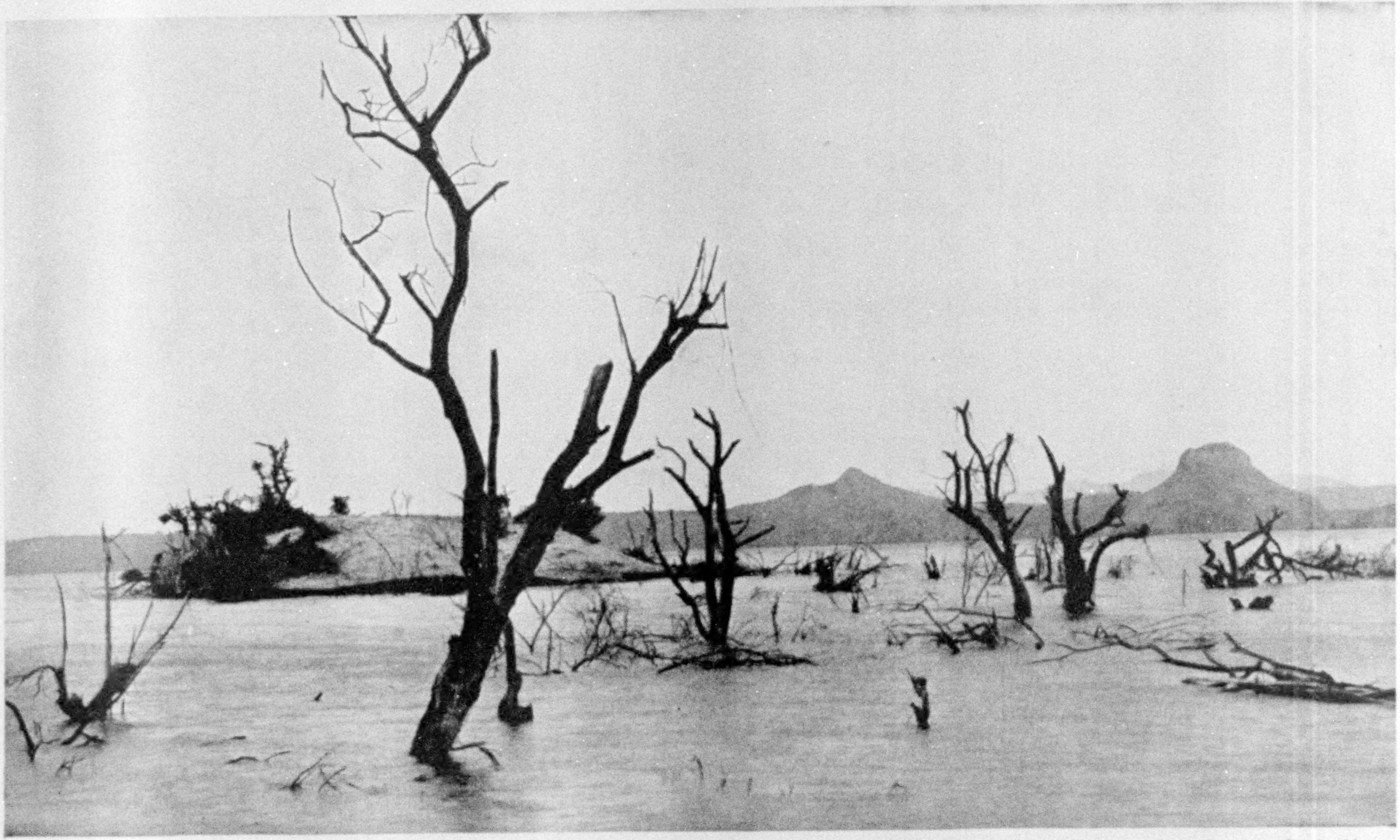


Photo by Charles Martin

PART OF THE SHORE OF VOLCANO ISLAND SUBMERGED DURING THE ERUPTION

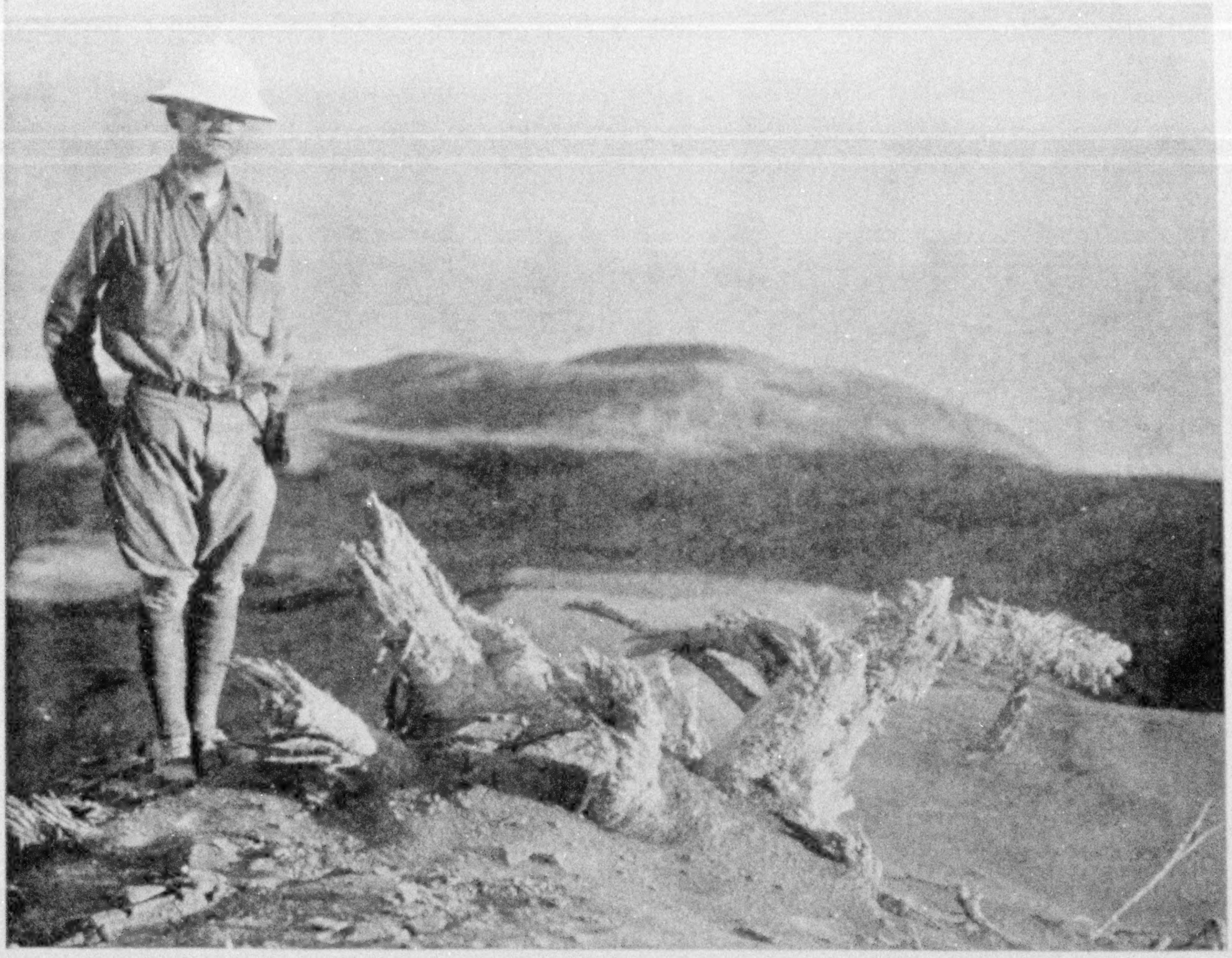


Photo by Charles Martin

STUMPS OF TREES ON VOLCANO ISLAND

The trees were torn off by the blast from the crater. Note that the bark is cut to pieces but not burned (see page 355)

fallen in any considerable quantity. Suffocation was undoubtedly also an important cause of death.

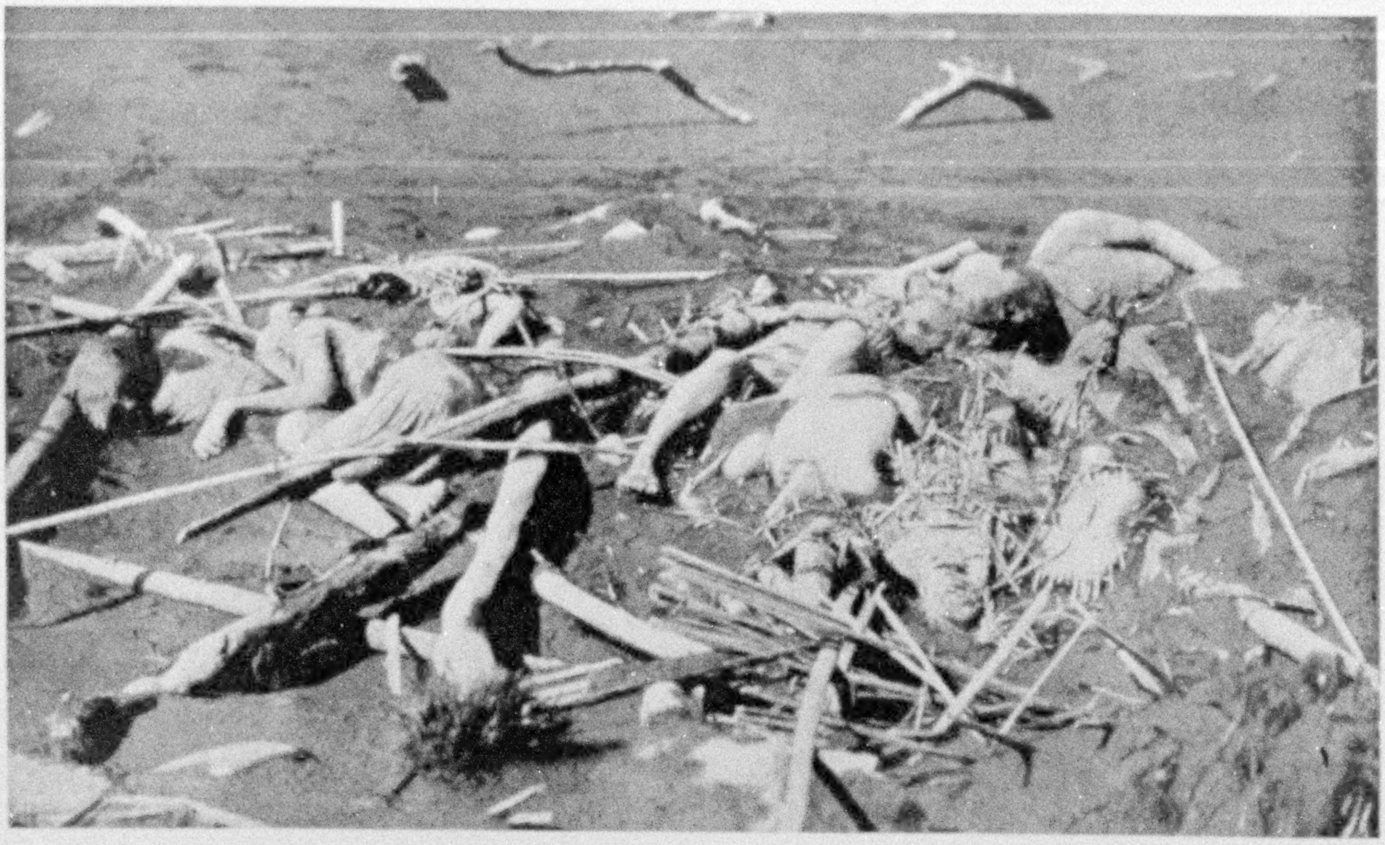
There is strong evidence that there were a number of extremely local explosions, confined to single houses or to individual rooms in houses, which were apparently caused by the ignition of explosive gases from the volcano. The victims of such explosions may well have been burned by fire.

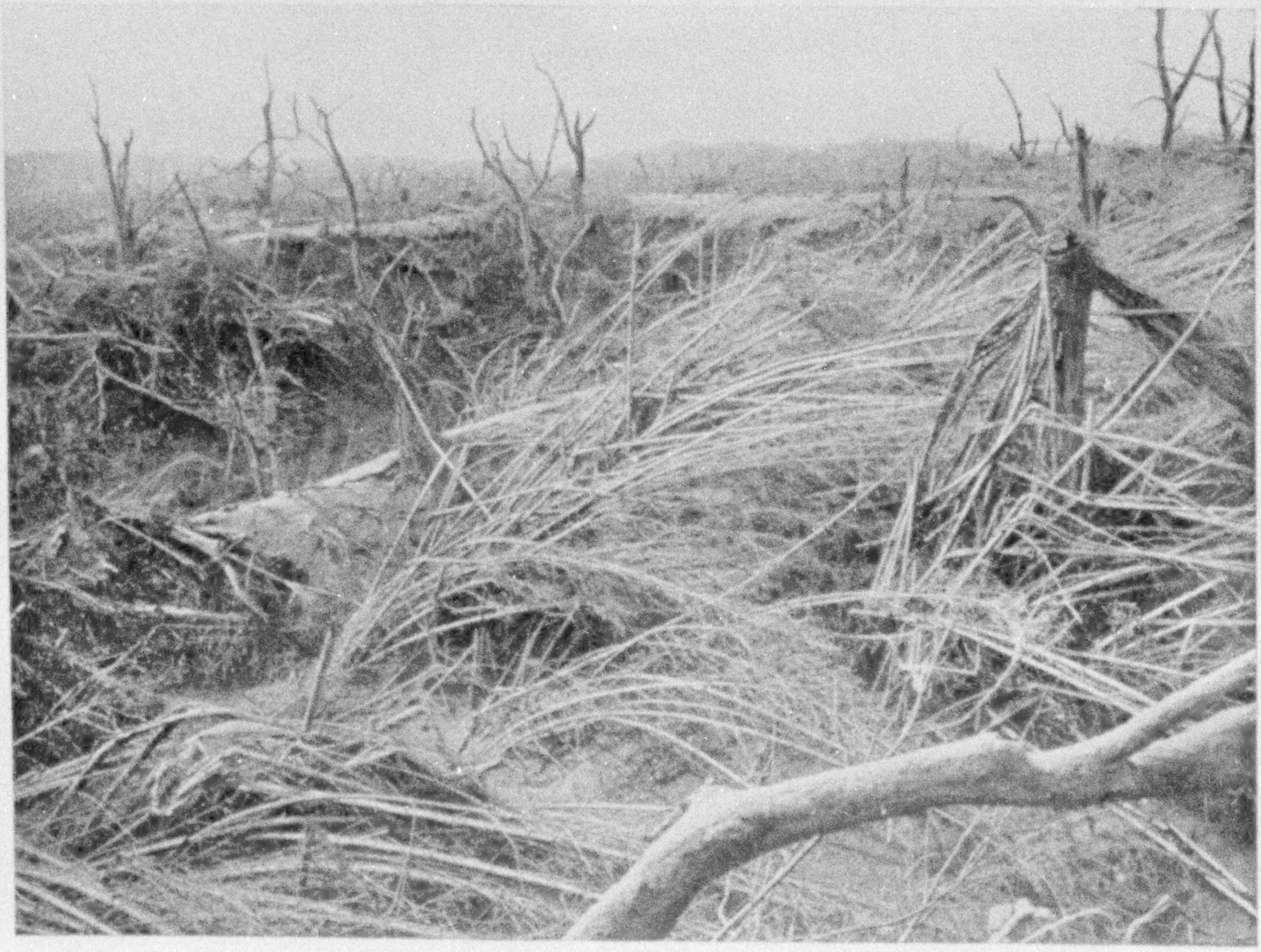
Red Cross funds and other relief funds were speedily made available, and food and shelter were immediately provided for the destitute and the homeless. Work was provided for the able-bodied by the inauguration of road construction in the vicinity.

A distressing feature of this calamity was that crops and grasses were killed over immense areas within which no other very serious damage was done, with the result that a large number of domestic animals starved to death.

There was at the outset a woeful lack of appreciation of the magnitude of the calamity, due in part to the causes already mentioned, and in part to the fact that such really authentic statements as were at first made relative to the havoc wrought were rather heavily discounted, both by the Manila public and by government officials, accustomed as they all were to greatly exaggerated first reports of the damage caused in the Philippine Islands by typhoons, conflagrations, and earthquakes.

Undoubtedly a limited number of wounded persons, whose lives might have been saved by quicker action, perished miserably; but on the whole the relief work was efficient, in view of the great obstacle encountered in the lack of water transportation, a lack which should never





Photos by Charles Martin

SOME OF THE DEAD IN THE VILLAGE OF BIGNAY: SMOTHERED AS THEY SLEPT AND BURIED IN THE RUINS OF THEIR FALLEN HOUSES

SCENE ON THE MAINLAND WEST OF THE VOLCANO, SHOWING THE EFFECT OF THE BLAST FROM THE CRATER

XUM

again be allowed to exist on Bombon Lake.

The official figures as to the number of dead and wounded have already been given, but as whole villages were wiped out of existence, and as the survivors in other villages were scattered, it necessarily follows that the exact number of persons who perished will never be known.

PHOTOGRAPHER MARTIN STILL UNDAUNTED

Mr. Martin and his companions set out from Bañadero for Volcano Island in a partially crippled launch at 1 p. m. on the day of the eruption. Mr. Martin reached the crater rim at 3 p. m. and completed his remarkable series of photographs, although the activity within the crater was still terrifyingly intense and the earth was constantly shaking under his feet. At 3:45 the party left.

Fifteen minutes later there occurred a tremendous explosion (see pages 335, 346, and 348), which again deluged the island with mud, while a black cloud of noxious fumes rolled down the slopes of the volcano to, and over, the neighboring waters of the lake.

Of this adventurous journey Mr. Martin says:

"At the time, it was my own opinion that absolutely no animal life could have withstood and lived through the eruption on the island; it was completely devastated, not a blade of grass escaping. Large trees 8 inches in diameter were broken, leaving stumps of 1 foot or 1½ feet high. The ends of these stumps were shredded like whisk-brooms by the fall of sand and small stones driven by the force of the eruption. A large stone weighing not less than 600 pounds was projected clear on top of the highest ridge.

"A rock was found with its surface fused, giving it the appearance known as 'bread-crust'; the greatest diameter of this stone was one meter. But I did not see any fire or red-hot stones thrown up. The heat was possibly enough to fuse rock, but of course from Tanauan I could not see such things erupting, and while I was on the crater's rim there was nothing thrown up that could possibly be called 'fiery.' The eruption consisted mainly of mud, and very wet mud at that.

"The trees on the island were broken and were found lying in a direction radiating from the crater. The fall of the mud, though sufficient to break up all branches, was not sufficient to break the trunks, which were nevertheless torn off at 1 to 1½ feet from the ground. Such results were caused by the terrific explosions.

"The whole island had also subsided about 8 to 10 feet. This is readily attested by the trees, which used to be on high ground and are now found several feet in the water. Such trees do not live in the water."

Mr. Martin subsequently accompanied relief parties and also went with the men sent out by the Bureau of Science to investigate the results of the seismic activities which had accompanied the eruption, so that his series of photographs very fully covers both the eruption and its material effects in the surrounding country.

THE DEVASTATING BLAST FROM THE CRATER

There has been much discussion as to the cause of the devastating blast from the crater, and as to the reason why its effect was so much more serious on the west coast of the lake than elsewhere.

There is no doubt that an immense body of steam and gases, heavily charged with fine volcanic ejecta, swept downward and outward in all directions from the crater rim. It stripped Volcano Island bare of all vegetation; caused a huge wave to extend outward over the surface of the lake; blew houses to bits; broke off many great forest trees; bent saplings, bushes, bamboo, and tall grasses to the ground on the mainland; and dealt instant death to every living creature fully exposed to its fury. The human beings who escaped owe their lives to the fact that they were blown into the lake, or were in especially protected spots.

EXPERIENCES OF PRIVATE COUCH

The few survivors within the zone of devastation were so overwhelmed by the

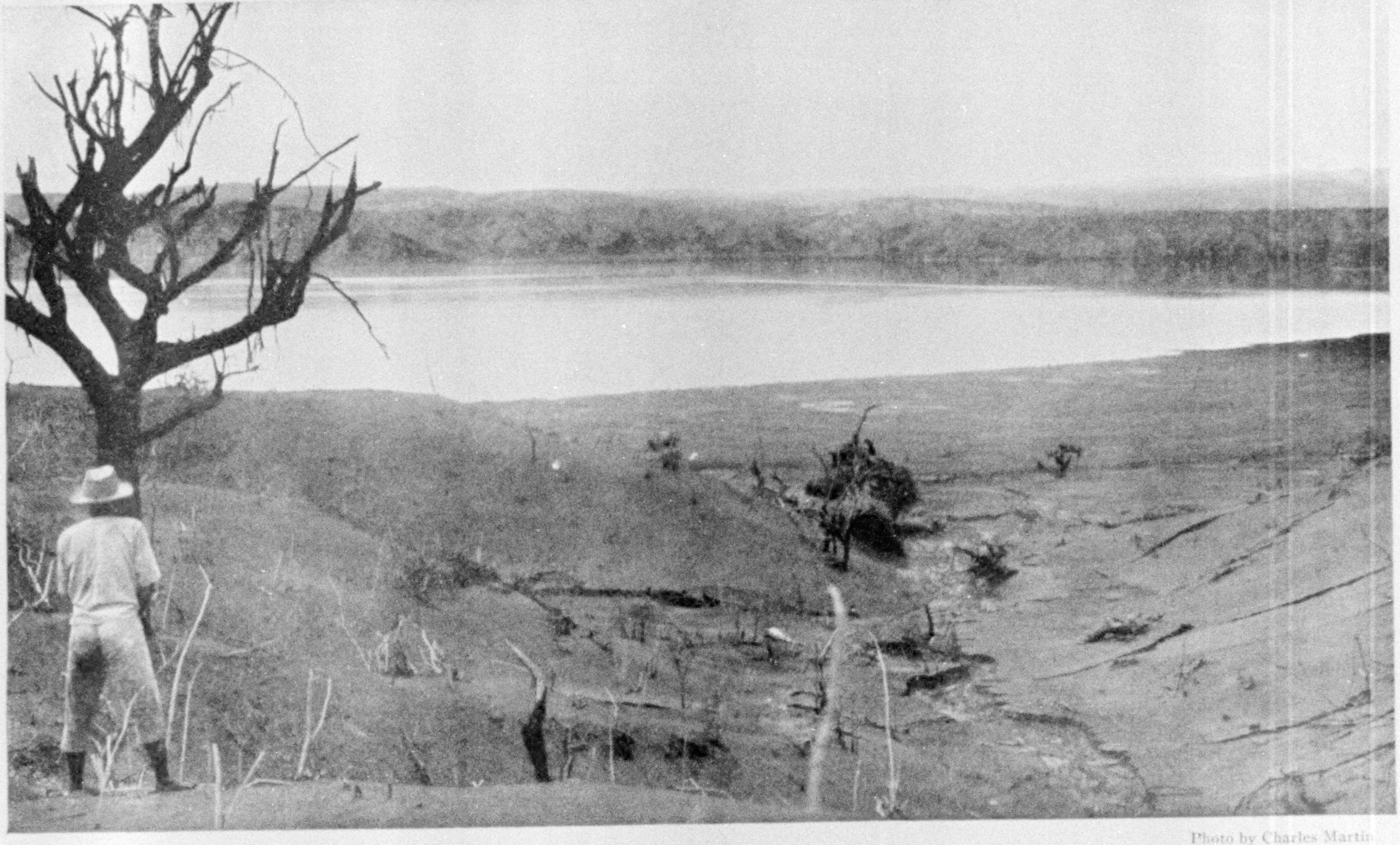


Photo by Charles Martin

SITE OF THE VILLAGE OF PIRAPIRASO, ON VOLCANO ISLAND, IN THE ZONE OF COMPLETE DESTRUCTION

Not a living thing escaped in this village. It was devastated by a blast from the volcano, and its ruins were then swept into the lake by the receding of a wave which was caused by the blast or by seismic action

XUM

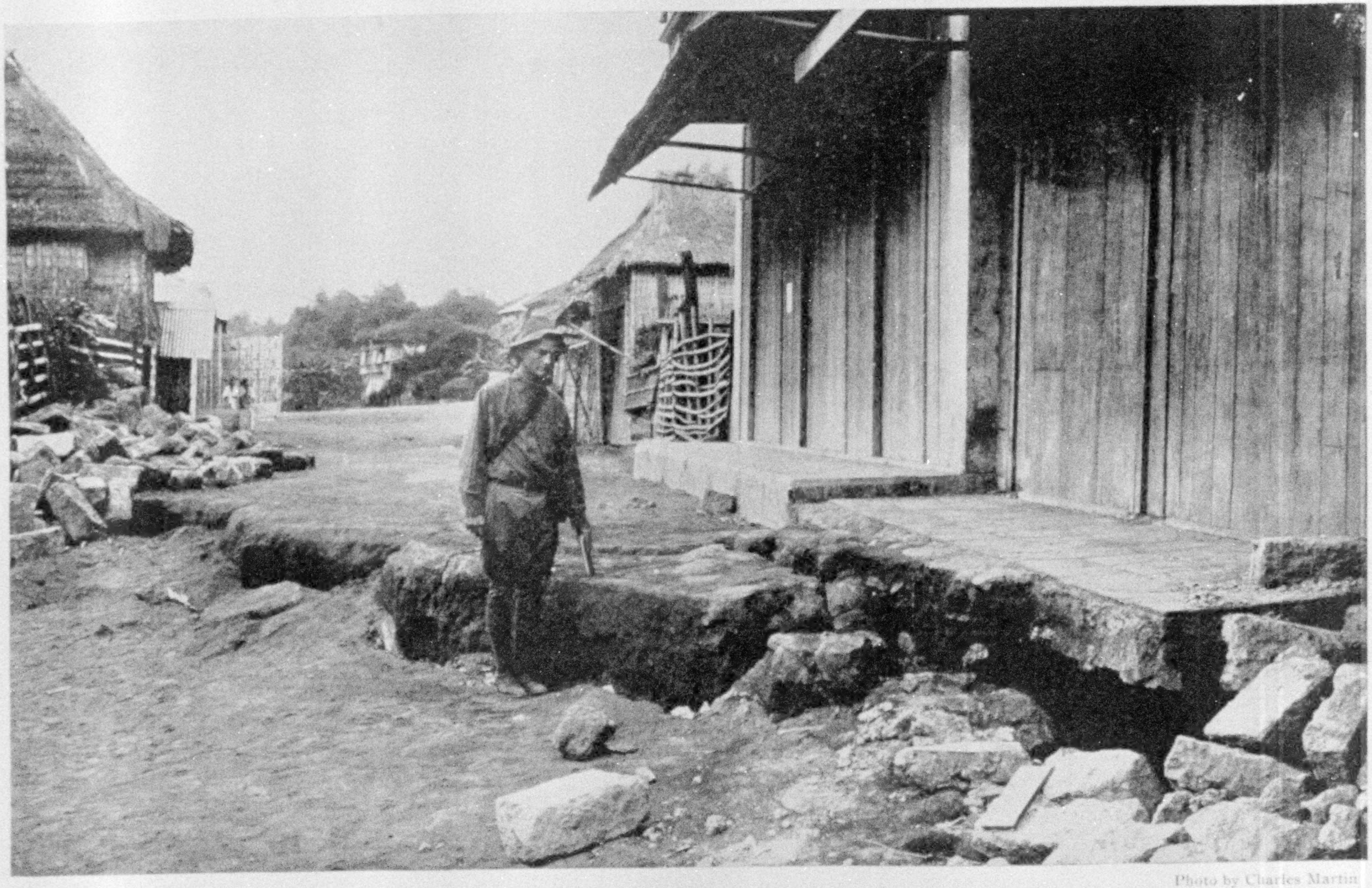


Photo by Charles Martin

THE EARTHQUAKES WHICH OCCURRED DURING THE ERUPTION CRACKED THE GROUND AS FAR AWAY AS LEMERY, WHERE THIS PHOTOGRAPH WAS TAKEN dreadful experience through which they had passed that for the time being they nearly or quite lost their reason, and later could give no intelligible account of what occurred. Special interest, therefore, attaches to the statement of private William C. Couch, Company "E," 2d Battalion, Engineers, U. S. A., who was at Bayuyuñgan, where the destruction was only partial and where but 98 persons out of 800 were killed. He says:

"With a mapping and surveying party I was camped at Bayuyuñgan, Batangas, on January 28, 1911, when the Taal volcano went into a state of eruption. The camp was located about four miles northwest of the crater and about a quarter of a mile from the shore of Lake Taal. About 3 a. m., January 28, the volcano showed signs of eruption. There were severe reports caused by the explosion of gases above the crater and an electrical display lighted up the heavens. Large volumes of smoke were pouring out of the crater and were carried off to the southward by the wind. This condition lasted about three minutes. Earthquakes of more or less severity were felt throughout the dawn of January 28. Smoke issued from the crater and ashes fell in our camp nearly all the day.

"On January 29 heavy volumes of smoke poured out of the crater, accompanied by slight earthquakes, until about 4 p. m., when a severe quake was felt. I was asleep under a tree and was nearly thrown from my bunk by the violence that ensued. The shocks then lessened in frequency and severity until about 11 p. m., when another heavy shock was felt. After this we went to sleep.

"About 1 a. m., January 30, I was awakened by a loud rumbling noise. I got up and stepped outside of the tent. Looking across the lake in the vicinity of the volcano I saw great volumes of black smoke pouring out of the crater, accompanied by heavy explosions, resembling heavy artillery in action, and electrical display. The smoke drifted over our camp and there was a light fall of ashes. The explosions ceased, and thinking that the disturbance was at an end we again retired and most of the men had gone to sleep when the loud rumbling noise was again heard, and before I could get out of bed an explosion of indescribable severity took place.

"On getting out of the tent I saw the smoke was coming out of the crater in dense clouds. Thinking that there was going to be an eruption, I awakened the sleeping men and wanted to vacate the camp, but we finally concluded to remain.

"The rumbling noise grew louder and louder and then a heavy report. I then saw the mud issuing from the crater as a cloud. In a few seconds I saw this cloud drifting across the lake toward our camp. Our camp was then swept by a heavy wind which broke the tent ropes and threw the tent into the air. This atmospheric disturbance threw me a distance of about 15 feet.

"Then there was a rain of ashes which fell to the depth of about 8 inches. The air was oppressive and we had to gasp for breath; this lasted about 20 seconds. Then there was a light warm shower of rain, followed by another fall of ashes, which lasted about half a minute. After this there was a cold heavy fall of rain that continued for about 15 minutes.

"By this time a tidal wave from the lake had reached our camp (a distance of about a quarter of a mile) and we took to a small hill about 50 yards away to the north of the camp. The bamboo and underbrush on this hill was so twisted that we could not penetrate it, but we had reached a safe elevation and we rested and waited for day to break. While waiting at this place a scout soldier came to us. Seeing a native coming across a field with a torch, the scout hailed him and he came to us and took us to a native house near by, where we remained until daylight.

"After daylight we returned to the site of our camp to recover what articles we could, but we found that everything had been washed away. We then started for Lemery, about 28 miles away, reaching that place about 5 p. m., January 30,

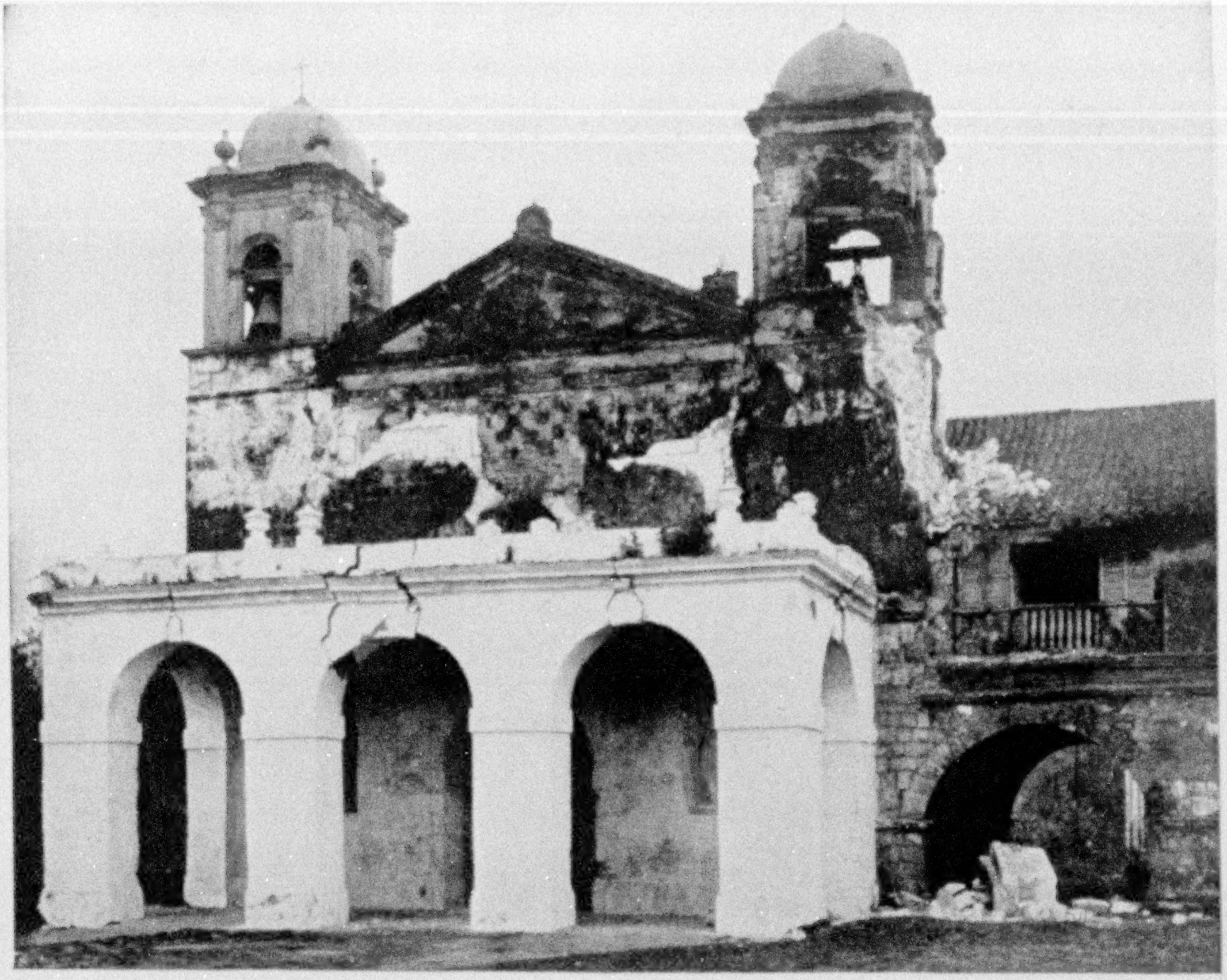


Photo by Charles Martin

CAYSASAY CHURCH, IN THE TOWN OF TAAL, SHOWING DAMAGE CAUSED BY EARTHQUAKES DURING THE RECENT ERUPTION

(See page 320 for the story of this church in the eruptions of 1754)

hungry, thirsty, and worn out by our experience. One of the party was slightly burned about the arms with hot ashes, but otherwise we did not suffer any bodily injuries."

The fact that the zone of greatest destruction was to the west may be partly due to the lowness of the crater wall on this side.

It has been claimed that the gentle wind which was blowing at the time greatly influenced the direction taken by the devastating blast, but in view of the fierceness of the blast I confess myself unable to accept the theory that its direction was greatly influenced by a mere breeze.

Father Algué has suggested that the air above the crater was heavily charged with the matter thrown upward by the very severe explosion which had occurred a short time before, and that the inertia of this mass was sufficient to turn outward and downward the uprushing column of ejecta. Whatever may be the physical explanation, there is no doubt as to the fact.

The eruption spread mud and volcanic ash in readily perceptible quantity over an area some 1,200 square miles in extent. Dust fell over a very much more extensive area, especially to the northward. Much of the ejected mud was quite fluid and ran into ravines and other low places, thus creating misapprehension in the minds of careless observers as to the depth of the deposit.

On the western slopes of the volcano, where the fall was heaviest, it reached a depth of 6 feet or more in ravines, while ridges were often left nearly bare. Mr. Pratt considers the average depth here

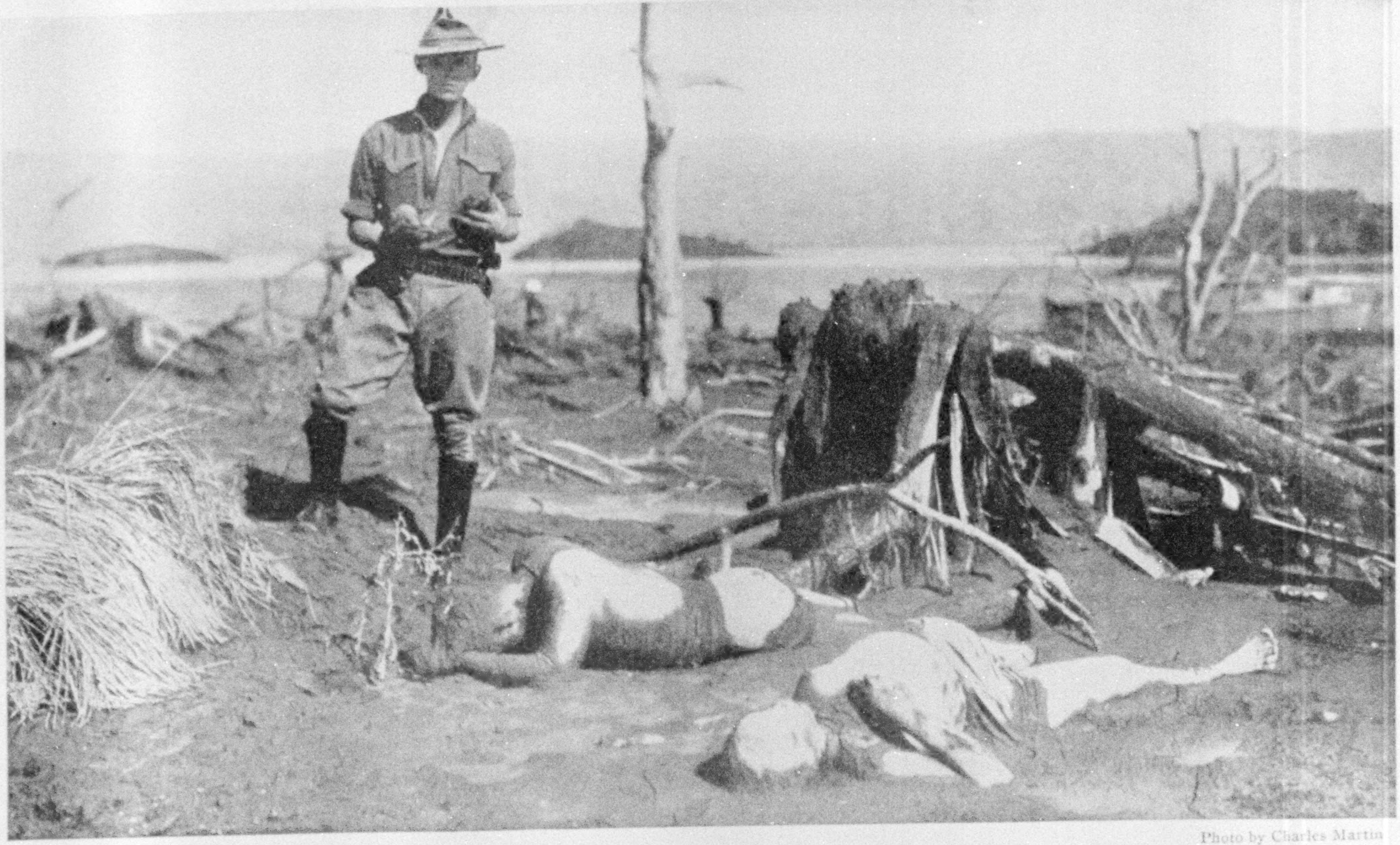
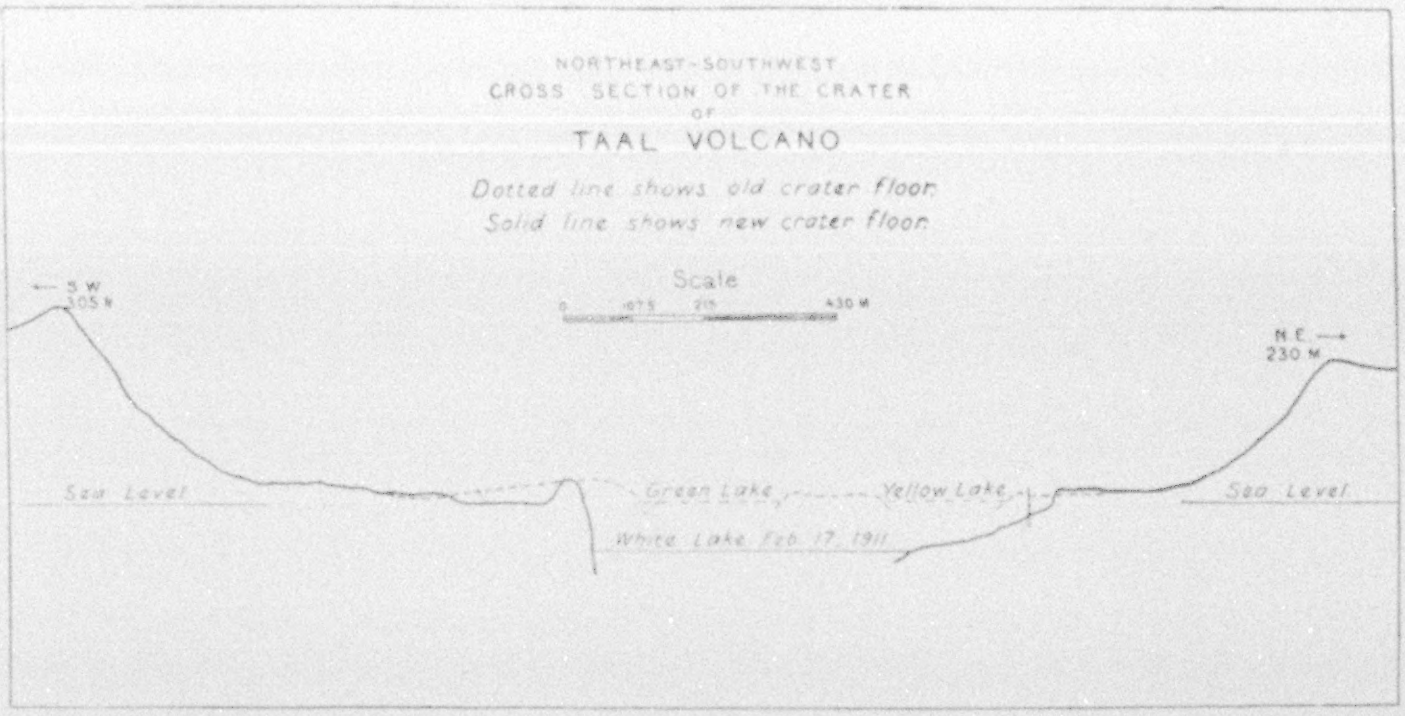


Photo by Charles Martin

THE DEAD AND THE LIVING

Among the few creatures which escaped death on Volcano Island during the great eruption were two puppies, which may be seen in the hands of the constabulary officer



CROSS-SECTIONS OF TAAL VOLCANO BEFORE AND AFTER THE GREAT ERUPTION

to have been 8 to 12 inches. On the neighboring mainland it was slightly less.

Newspaper reports, to the contrary notwithstanding, there was no flow of lava during this eruption, nor is there evidence that there has ever yet been a lava flow from this volcano.

While a number of observers report having seen a bright glow in the cloud overhanging the crater, and while Father Saderra Masó has suggested that this may have been due to the reflection of light from a mass of exposed lava, which was soon afterward blown to fragments by escaping steam, the fact remains that no particles of fresh lava can be detected in the mud or ash thrown out, and this theory must therefore be abandoned. The glow observed was doubtless caused by incandescent gases or by electrical discharges.

It is certain that incandescent rocks were ejected, although in comparatively small number. Most of the rocks thrown out, whether glowing or not, were of small size.

Attention has already been called to the fact that the ejected mud was strongly acid. It burned every living thing on which it fell and, driven by the force of the great explosion, tore the bark from trees and the skin from human beings.

THE AREA OF DEVASTATION

The area materially affected by the seismic disturbances caused by this eruption was some 200 miles in diameter. The number of such disturbances which occurred before, during, and soon after the eruption was extraordinary. From January 27 to February 7, inclusive, there were recorded at Manila 472 disturbances of intensity I, 97 of intensity II, 76 of intensity III, and 62 of intensity IV, with sufficient additional micro-seismic disturbances to bring the total up to the unprecedented number 995.

The more violent earthquakes greatly alarmed people as far north as Manila, but actual damage was practically limited to the land area inclosed between the two fissure lines shown on the map on page 315. Along these lines there were vertical displacements of 1 to 2 or more yards. The highway along the sea near Lemery sunk so that it was under water at high tide.

At Sinisian, where the westernmost of the fissure lines intersects the coast line, there formed on the sea beach a little crater, from which mud was at times ejected to a height of 100 feet. Puffs of gas were in a number of instances discharged with considerable violence when the fissures opened. A great part of the region between the two fissure lines settled materially. Volcano Island

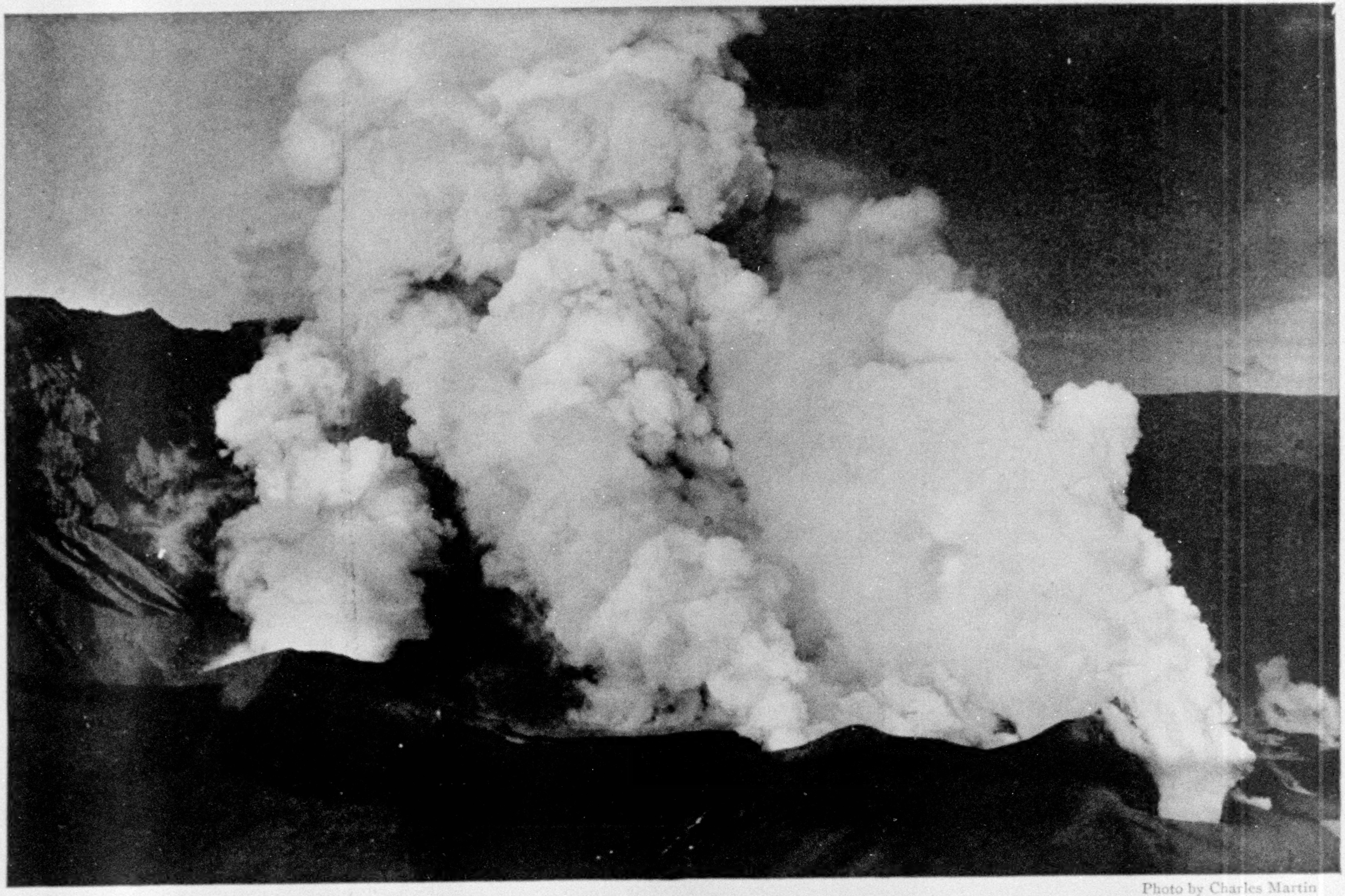


Photo by Charles Martin

PORTION OF TAAL VOLCANO THE AFTERNOON BEFORE THE GREAT ERUPTION

Crater of 1904 at the left; main crater in center; small new crater at right. Contrast this photograph with the one which follows

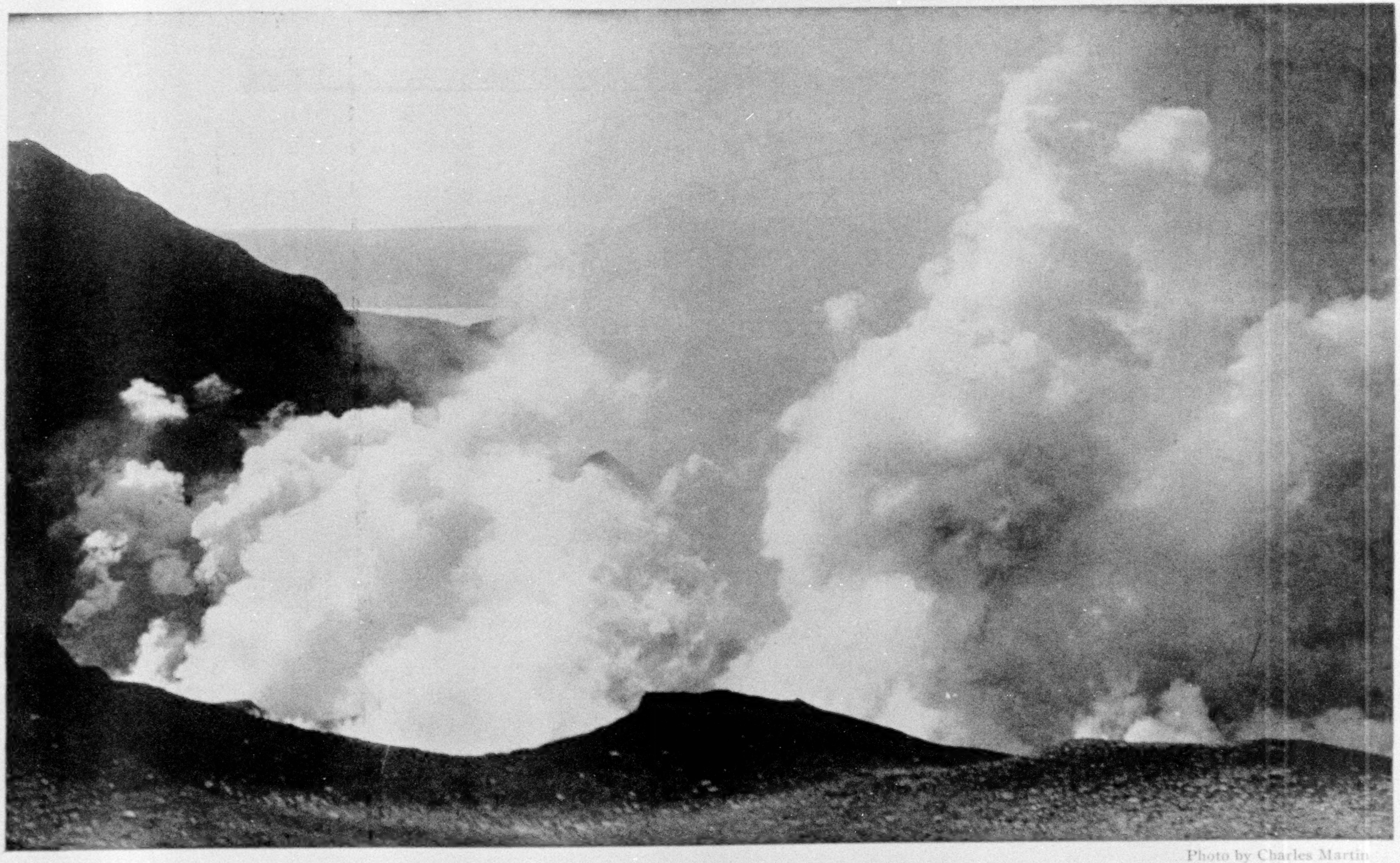


Photo by Charles Martin

A PORTION OF THE CRATER OF TAAL VOLCANO THE AFTERNOON AFTER THE GREAT ERUPTION

This photograph was taken from the same position as the preceding one. The three craters shown there have now become a part of one great crater, from which protrudes an obelisk barely visible through the clouds of steam. Note how the earth in the foreground is pitted by falling stones

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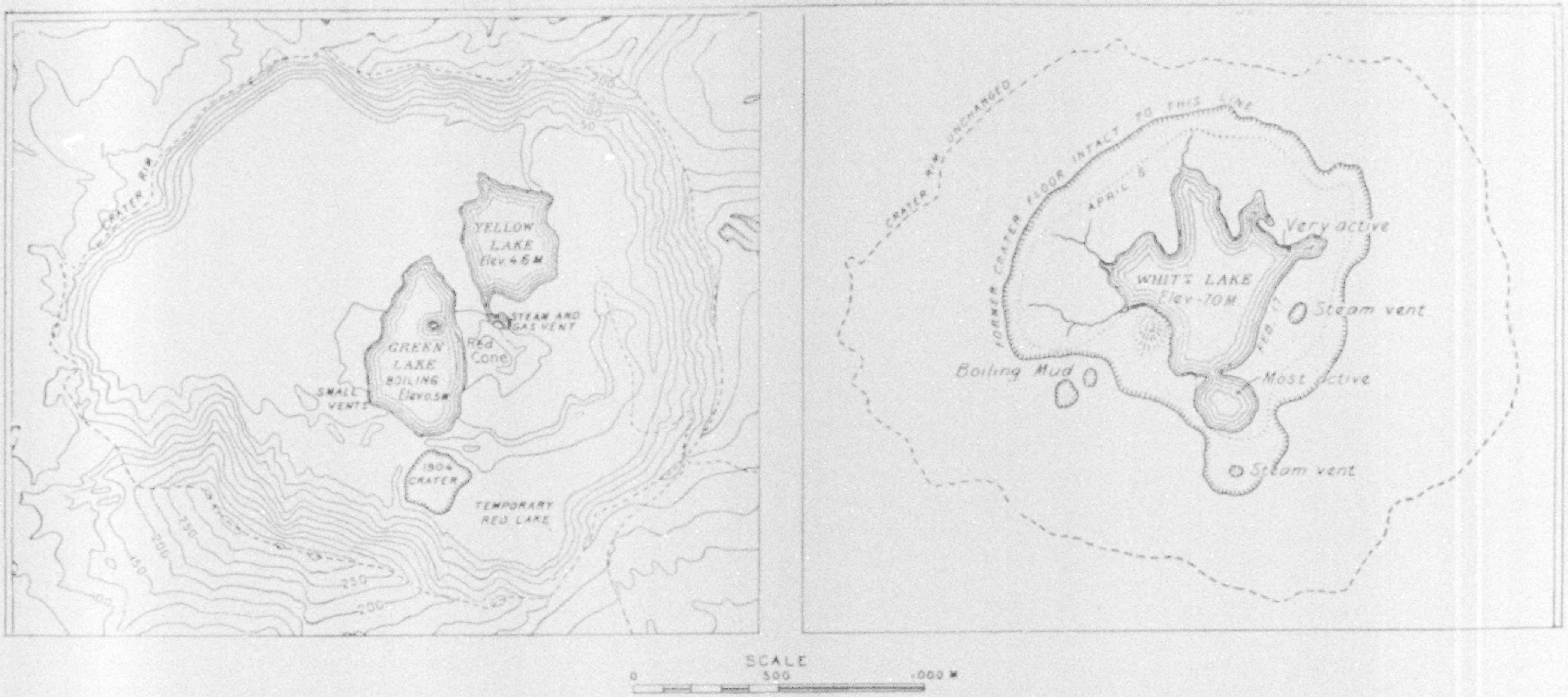
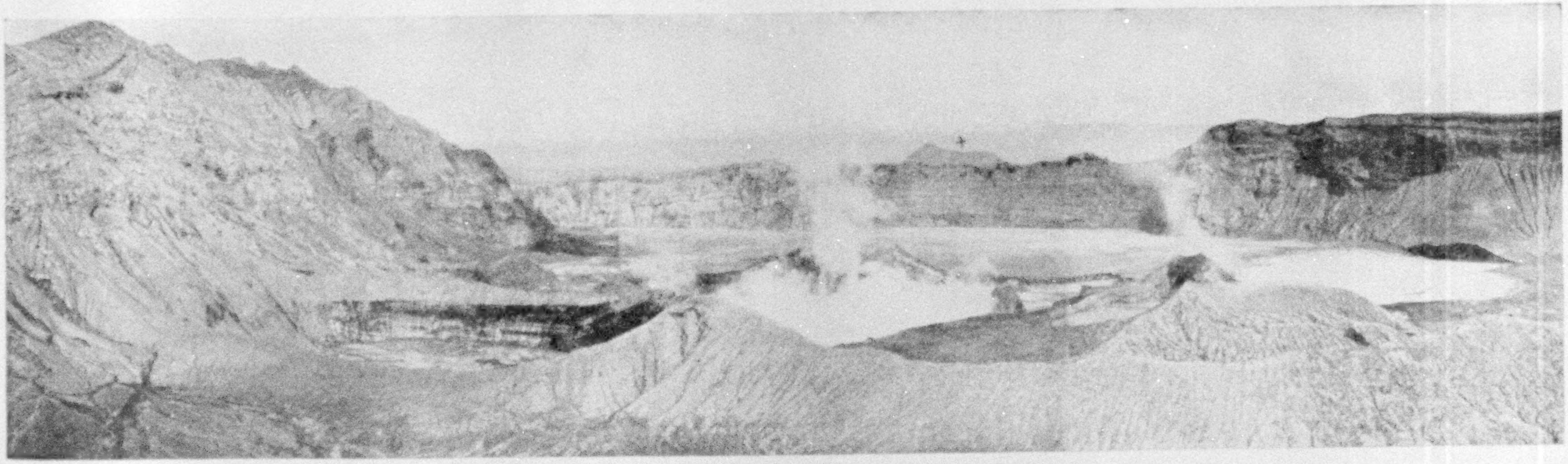

CRATER RIM
YELLOW LAKE Elev. 4.6 M
STEAM AND GAS VENT
Red Cone
GREEN LAKE BOILING Elev. 0.5 M
SMALL VENTS
1904 CRATER
TEMPORARY RED LAKE
200
150
250
CRATER RIM UNCHANGED
FORMER CRATER FLOOR INTACT TO THIS LINE
APRIL 8
FEB 17
WHITE LAKE Elev -70 M
Very active
Steam vent
Most active
Steam vent
Boiling Mud
SCALE
0
500
1000 M

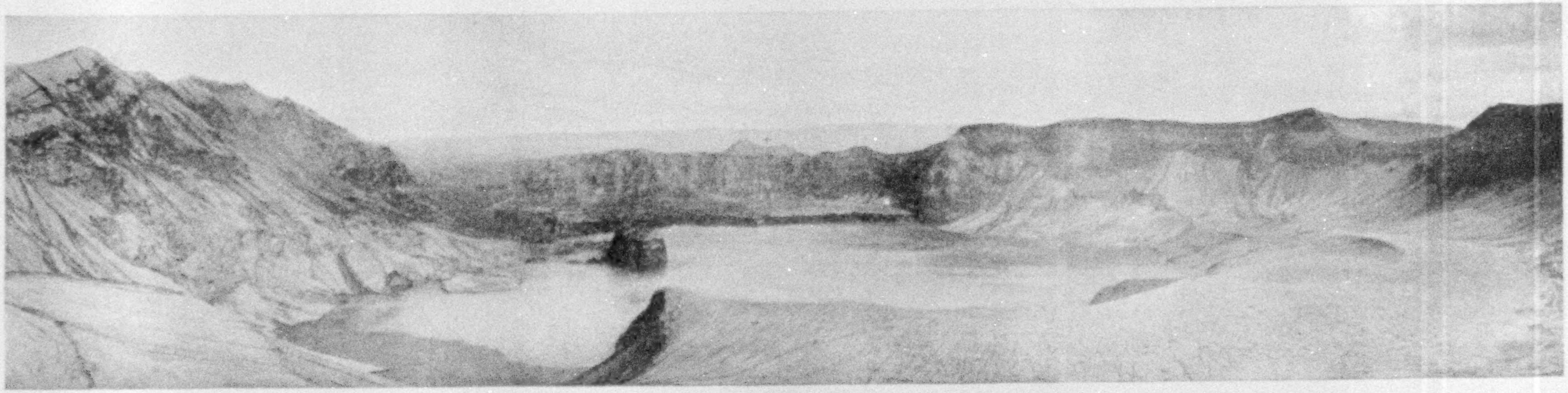
OUTLINE MAPS SHOWING THE CRATER OF TAAL VOLCANO IMMEDIATELY BEFORE AND SHORTLY AFTER THE GREAT ERUPTION

The map at the left shows the crater as it was just before the great eruption. The blue lake, observed by Secretary Worcester in 1888, had completely disappeared. The 1904 crater had formed and at its base lay a temporary red lake formed during the rainy season. Otherwise the crater had remained practically unchanged since 1888. The map at the right shows the effect of the great eruption which blew out the former crater floor within the area inclosed by the hatched line. On February 17, 1911, a rapidly forming new white lake had reached the dimensions shown in the map to the right, and on April 8 it had extended so as to cover the area inclosed by the dotted line. (From the Philippine Journal of Science, Vol. VI, No. 2.)



PANORAMIC VIEW OF THE CRATER OF TAAL VOLCANO BEFORE THE GREAT ERUPTION, LOOKING WEST

Binintiang Malaqui marked with a cross. Crater of 1904 partially filled with mud at the left. Active crater in the center. Steam issuing at the right where a small crater formed in January, 1911



PANORAMIC VIEW OF THE CRATER OF TAAL VOLCANO AFTER THE GREAT ERUPTION, LOOKING WEST Photos by Charles Martin

Binintiang Malaqui marked with a cross. The lake is some 1,200 yards long, and was formed after the great eruption by water pouring in from Bombon Lake through the cracks in the crater wall

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settled from 3 to 6 feet and parts of it much more than this.

Some persons believe that the wave extending outward from the volcano, which swept the lake shore and caused such serious loss of life and damage to property, was caused by the sudden subsidence of the island, but such an occurrence would probably have been attended by a severe earthquake, and there was no earthquake at this time. Indeed there is very definite direct evidence that the settling was gradual. When Mr. Martin first visited the island after the eruption, the floor of Mr. Ward's house was just awash. When he returned later the house was completely submerged.

COMPARISONS WITH MONT PELÉE

It is interesting to compare the results of this eruption with those of the eruption of Mont Pelée, which occurred in May, 1902. The area devastated by Pelée was approximately 52 square miles; that devastated by Taal was approximately 142 square miles. Pelée killed some 30,000 people, while Taal killed only about 1,400, but this comparatively small number of casualties was due solely to the fact that the territory devastated was very sparsely inhabited. The village of Gulad was the same distance from the crater of Taal as was St. Pierre from the crater of Pelée. In Gulad 116 out of 120 inhabitants were killed outright and the four survivors were dreadfully injured. Had there been a large city at this distance from Taal the mortality would have been horrible.

The force of the eruption from Pelée would seem to have been greater than that from Taal, as Pelée spread ashes in one direction for a distance of 100 miles, whereas the greatest distance to which Taal sent any considerable fall of ashes was 32 miles.*

Why, then, was the zone of complete destruction around Taal so much larger than that around Pelée? The probable explanation is a simple one. In each instance the expanding mass of gases from the crater tended to extend itself in all directions. The crater of Pelée was some 4,002 feet above the sea, while the crater rim of Taal was in places less than 400 feet above the lake.†

Mr. Pratt has called attention to the fact that this eruption of Taal may be accurately described in the following words applied by Hovey to the eruptions of La Soufrière and Mont Pelée in 1902:

"It is evident that there was a blast or a series of blasts of hurricane violence from the crater . . . as a feature of the eruptions. . . . The overturned trees constitute the principal evidence. . . . They all point away from the crater except for slight modifications due to local topography. The blast extended radially in all directions from the crater, suggesting the explanation that some great volume of steam, rising from the throat of the volcano, could not find room for expansion upward on account of the column of steam and ashes which had preceded it and the ashes falling therefrom, and that it expanded with explosive violence horizontally and downward, following the configuration of the mountain."

TODAY TAAL VOLCANO SLUMBERS PEACEFULLY

Today Taal Volcano slumbers peacefully. The great gap recently torn in its crater floor is filled by the shimmering waters of a placid lake, from which there hardly rises so much as a whiff of steam; but somewhere below that smiling surface titanic energies are again slowly but surely gathering. Sooner or later they will once more rend the solid earth asunder in an explosion which will blow rocks and earth to powder and drive that powder in a death-dealing blast across the neighboring country. What precautions should be taken to prevent future great loss of life?

The reason why the last eruption of Taal killed more people than have any of its known predecessors is that the territory in the vicinity of the volcano had become more thickly settled. The rich soil of this region tempts the Filipino farmers, who will rebuild many of the obliterated villages if allowed to do so. The inevitable result will be that sooner or later they or their descendants will be hurled into eternity, when the volcano again rouses from its sleep.

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*See National Geographic Magazine, 1902.

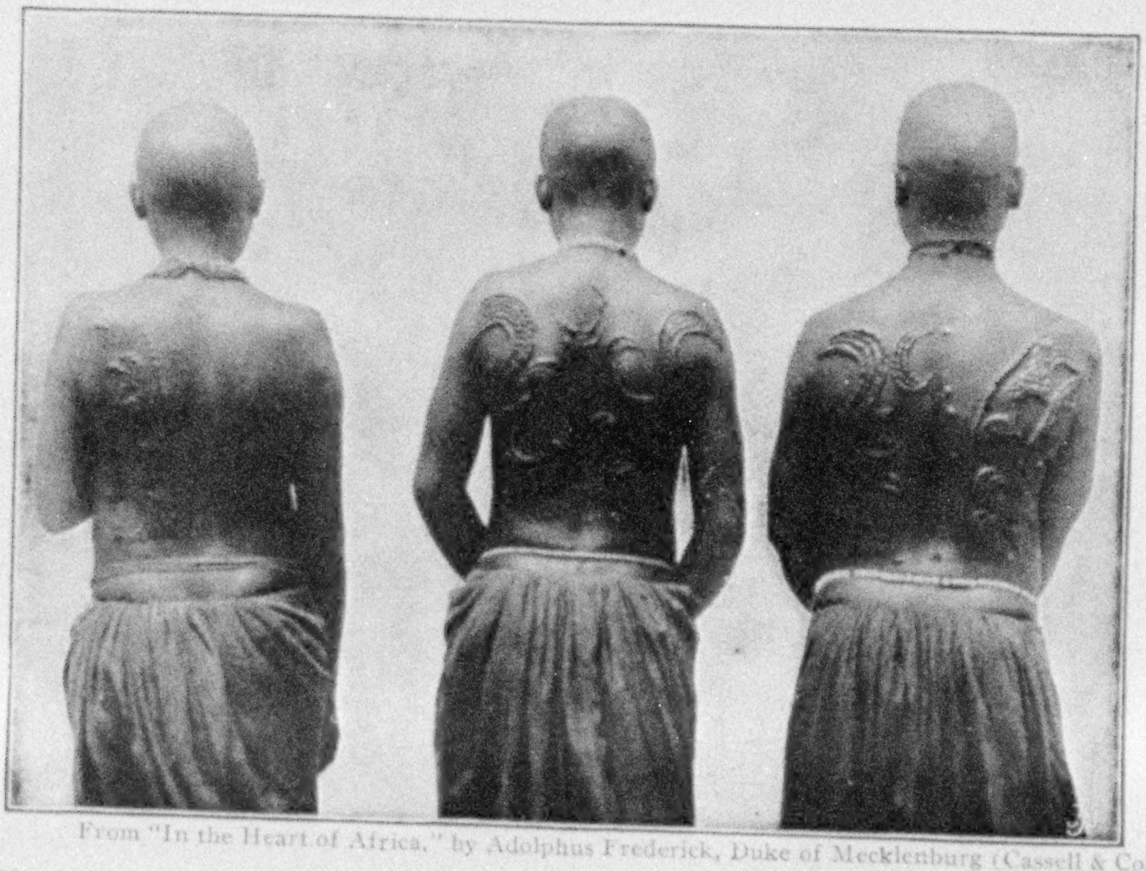
†Philippine Journal of Science, Vol. VI, No. 2, p. 83.

How are such conditions to be met? Shall residence within the danger zone be prohibited? And what *is* the danger zone? No one can say with certainty. Stretching across Cavite province to and beyond Manila are thick deposits of volcanic tuff believed to be composed of ejecta from the crater of a great volcano which once stood where Bombon Lake now lies. A new crater may form at any time along either of the fissure lines hereinbefore mentioned.

After the recent eruption the waters of Bombon Lake flowed slowly into Taal through fissures in its walls, forming the present crater lake. Should a seismic shock crack the earth's surface at this weak point and allow these waters to reach the fires underneath, what would be the result? It is certainly well within the limits of possibility that the map of Batangas Province might be suddenly and materially altered, and that the people of New England might again be favored with some of those wonderful red sunsets which followed the blowing up of Krakatoa.

One cannot travel fast or far in a country buried in mud, but the waters of Bombon Lake can be navigated except when they are being swept by typhoons or by giant waves due to profound seismic disturbances. It is certain that relief can best reach most points on the lake shore by water, and in my opinion the Philippine insular government should therefore maintain there, and keep ready for instant use in case of emergency, suitable and adequate equipment for water transportation. The establishment on Volcano Island of a small and very strongly constructed observatory, properly equipped with a universal seismograph and with apparatus for studying subterranean sounds, would be a wise precaution. There should also be established on the neighboring mainland a larger and more complete station, where an observer would reside and be on duty except when visiting the station on the island, which he should do daily. The seismic disturbances which precede an eruption would then be noted and timely warning given.

It would be a wise precaution to allow no one except scientific observers to reside within the known danger zone. So far as concerns Volcano Island, the prohibition should be sweeping and absolute.



From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

ORNAMENTAL SCARRINGS WHICH ARE POPULAR IN GERMAN EAST AFRICA

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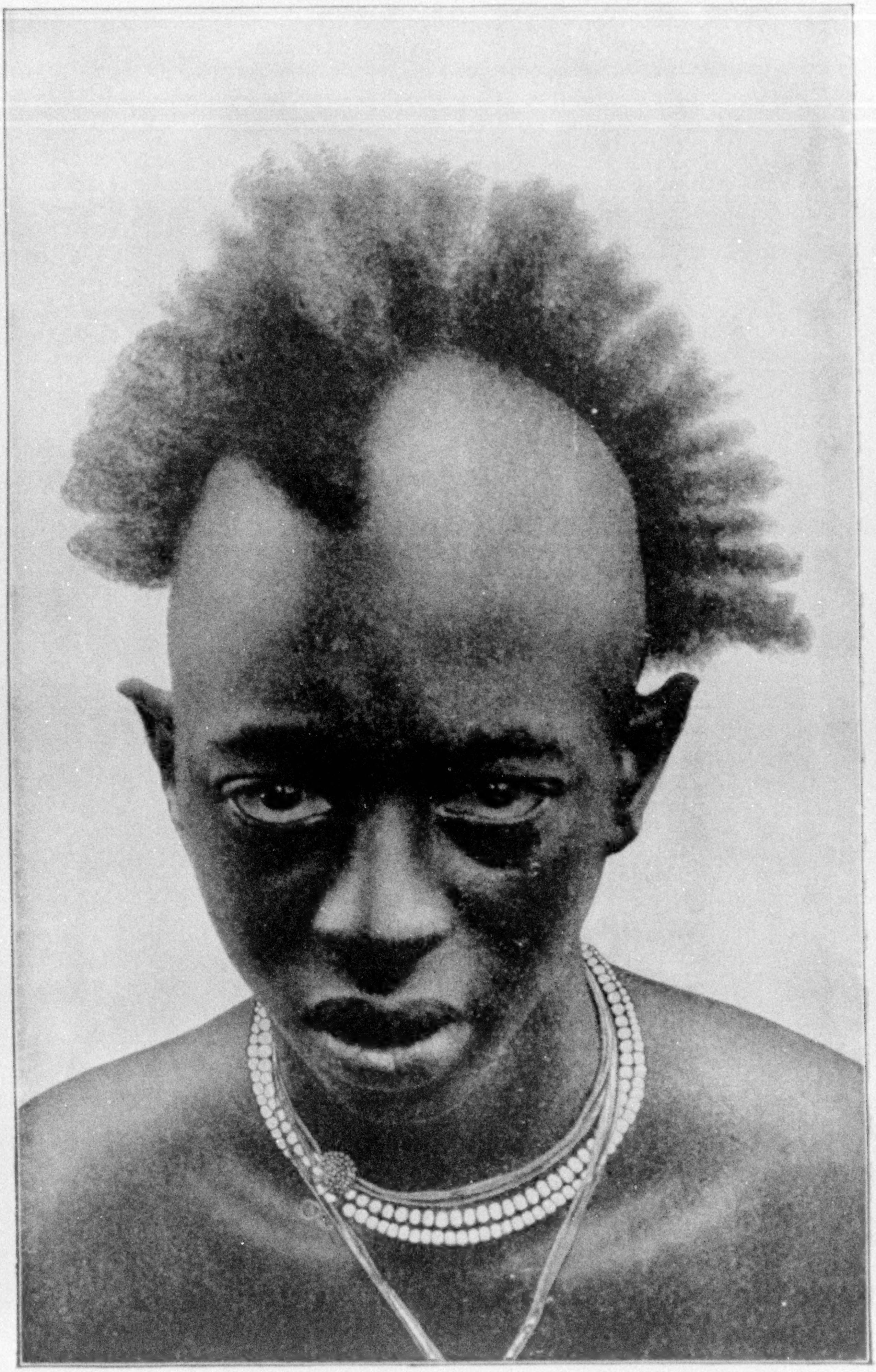

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg
Cassell & Co. (New York)

A WATUSSI OF GERMAN EAST AFRICA

A LAND OF GIANTS AND PYGMIES

By the Duke Adolphus Frederick of Mecklenburg

No section of Africa is so crowded with variety of interest as the large province of German East Africa. Its neighbor on the north, British East Africa, has been traversed by many big-game hunters and colonists, and described in scores of books, but the German possession is comparatively unknown. The Duke Adolphus Frederick of Mecklenburg has recently published a large volume describing two years' explorations in the German province. His book is packed with graphic and powerful descriptions of the strange peoples and remarkable group of active volcanoes in the territory. Through the courtesy of the American publishers, Cassell & Company, we are able to publish the following chapter from the book.

RUANDA is certainly the most interesting country in the German East African Protectorate—in fact, in all Central Africa—chiefly on account of its ethnographical and geographical position. Its interest is further increased by the fact that it is one of the last negro kingdoms governed autocratically by a sovereign sultan, for German supremacy is only recognized to a very limited extent (see map, p. 388).

Added to this, it is a land flowing with milk and honey, where the breeding of cattle and bee-culture flourish and the cultivated soil bears rich crops of fruit. A hilly country, thickly populated, full of beautiful scenery, and possessing a climate incomparably fresh and healthy; a land of great fertility, with watercourses which might be termed perennial streams; a land which offers the brightest of prospects to the white settler.

Ruanda is doubtless, with the exception of Urandi, the last sultanate or "kingdom" in Central Africa which is governed today, as in centuries gone by, by a prince clothed with absolute and illimitable powers. There is only one ruler, and no rival sultans are allowed.

To any one with an intimate knowledge of African affairs it seemed a sheer impossibility that so powerful a sovereign, the ruler over some one and a half million people, would voluntarily submit to the new régime and agree to enter upon no undertakings within his vast, thickly populated, and unexplored realms except by permission of the European Resident. To compel him to do so would have meant bloody wars and an enormous sacrifice of human life as the inevitable consequence. The sudden change of existing conditions, too, would have involved a heavy pecuniary sacrifice, as the government would have found it necessary, with such a large population, to appoint a relatively large number of European officials. As such measures would have proved impracticable, complete anarchy would have followed.

So the country was therefore allowed to retain its traditional organization, and the Sultan was given full jurisdiction over his fellow-people, under control of the Resident, who was to suppress cruelty as far as possible. In one word, the government does not acknowledge the Sultan as a sovereign lord, but fully recognizes his authority as chief of his clan. Kindred tribes, non-resident in Ruanda, are therefore not subject to the Sultan's jurisdiction, but are under the administration of the Resident.

The fundamental principle is the same with all Residents. It is desired to strengthen and enrich the Sultan and persons in authority, and to increase thereby their interest in the continuance of German rule, so that the desire for revolt shall die away, as the consequence of a rebellion would be a dwindling of their revenues. At the same time, by steadily controlling and directing the Sultan and using his powers, civilizing influences would be introduced. Thus by degrees, and almost imperceptibly to the people and to the Sultan himself, he

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From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

THE CARAVAN ON THE MARCH IN RUANDA

eventually becomes nothing less than the executive instrument of the Resident (see pages 373 and 374).

The people hold their "Mami," which is the official title of the Sultan, in the greatest awe and reverence. It is extremely rare for any one to venture to thwart his will, for the Sultan is the owner of the land and all the stock, oxen, calves, goats, pigs, etc. The people certainly enjoy the use of them, but the Sultan retains the power of demanding at his pleasure the return of his property from his subjects.

The population is divided into three classes—the Watussi, the Wahutu, and a pygmy tribe, the Batwa, who dwell chiefly in the bamboo forests of Bugoie, the swamps of Lake Bolero, and on the island of Kwidschwi on Lake Kiwu.

The primitive inhabitants are the Wahutu, an agricultural Bantu tribe, who, one might say, look after the digging and tilling and agricultural economy of the country in general. They are a medium-sized type of people, whose ungainly figures betoken hard toil, and who patiently bow themselves in abject bondage to the later arrived yet ruling race, the Watussi.

THE LONG-LIMBED WATUSSI

The immigration of the Watussi is, without doubt, connected with the great tribal movement which brought the Masai race to East Africa. The same arguments which have led observers to believe that the Masai came from the north and from Egypt, or perhaps even from Arabia, may also hold good in the case of the Watussi. As a matter of fact, many features common to both races may be discerned.

The Watussi are a tall, well-made people, with an almost ideal physique. Heights of 1.80, 2.00, and even 2.20 meters (from 5 feet 11½ inches to 7 feet 2½ inches) are of quite common occurrence, yet the perfect proportion of their bodies is in no wise detracted from. Whilst the shoulders are generally powerfully built, the waist is at times extraordinarily slender. The hands are elegant and delicate in form, the wrists of an almost feminine grace.

They possess that same graceful indolence in their gait which is peculiar to Oriental peoples, and their bronze-brown skin reminds one of the inhabitants of the more hilly parts of northern Africa.

Their heads are eminently characteristic. Unmistakable evidences of a foreign strain are betrayed in their high foreheads, the curve of their nostrils, and the fine oval shape of their faces.

The affairs of the country are administered by a number of subordinate chiefs (*watuales*), also *watussi* or *wahima*, who are superintendents of districts, yet are always subject to the supreme control of the ruler, who springs from the old Watussi race, the Bega. Frequent interviews with the Sultan necessitate many journeys to his residence, and it seems that at such times great quantities of *nsoga* have to be consumed, to facilitate the unraveling of awkward problems and to determine the measures to be taken. This is a brew concocted from bananas with malted red sorghum (Chinese sugar-cane), and manufactured at Kinjaruanda. The Sultan's court is at such times often the scene of wild orgies, tumult, and beating of drums, which on occasion continue all night.

Similarly to their sovereign ruler, the chiefs are descended from various distinguished families or clans. These clans hold land, pay taxes to the Sultan, are keen to avenge the bloodshed of kinsmen, and possess a totem—some object of adoration, which usually takes the shape of an animal or a plant.

THE PECULIAR TOTEMS

Every clan reveres a totem, which in Kinjoro is called *umuzimu*. Should the totem take the form of an animal, it is forbidden to kill or to eat such animals. This interdiction is closely connected with the widespread belief of transmigration of souls, for their creed teaches that the spirits of departed relatives enter the body of their object of adoration. The uncertainty obtaining as to which special totem the spirit of the deceased has entered makes it appear more prudent to the natives to abstain from slaying or eating any animals revered as totems; and doubtless this consideration gave rise to the prohibition.

In Ruanda the souls of the deceased rulers are believed to dwell in the leopard and to continue to torment their people in that shape.

The following are a few clans of the Wanjaruanda, with their totems:

The most widely distributed and most feared of the clans is that of the Bega; they have taken the toad as their totem. Another, the Wanjiginga, reveres the crested crane. The Bagessera worship the wagtail, or dish-washer. Farther away there is the clan of the Wankono, whose totems, I understand, are sheep and goats. The totem of the Bakora is the chameleon; the Wasinga's sacred object is a particular species of ox with a dirty brown-patterned hide; that of the Batwa, in the Bugoie forests, is the man-ape, and so on.

AN IDEAL CLIMATE FOR THE WHITE MAN

The high degree of civilization existing among the Watussi is assisted by climatic conditions. These are nearly ideal for an equatorial country. Intense heat is excluded by virtue of an average altitude of some 1,600 meters. The temperature prevailing generally is something like that of a warm summer day in Germany. It is refreshingly cool in the mornings and evenings, which is conducive to healthy sleep.

As the malaria-carrying mosquito (*Anopheles*) does not exist in this district, such a thing as an outbreak of fever is of rare occurrence. It is true that isolated malaria parasites are found in the blood of Ruanda natives, but these have doubtless been imported from less healthy regions, where the *Anopheles* is an acknowledged pest. According to Raven's researches, cases of malaria in Ruanda are insignificantly few in proportion to the density of the population.

The tsetse-fly, so destructive to man and beast, is non-existent, and this fact has, so far, protected the territory from the ravaging sleeping sickness which, as is well known, is disseminated by the tsetse-fly (*Glossina palpalis*).

The Watussi make the best use of their very favorable climatic conditions. The country possesses a fabulous amount of wealth in its herds, to the breeding of which this pastoral people are particularly devoted. Day after day immense herds of broad-horned oxen and small stock of all kinds may be seen grazing

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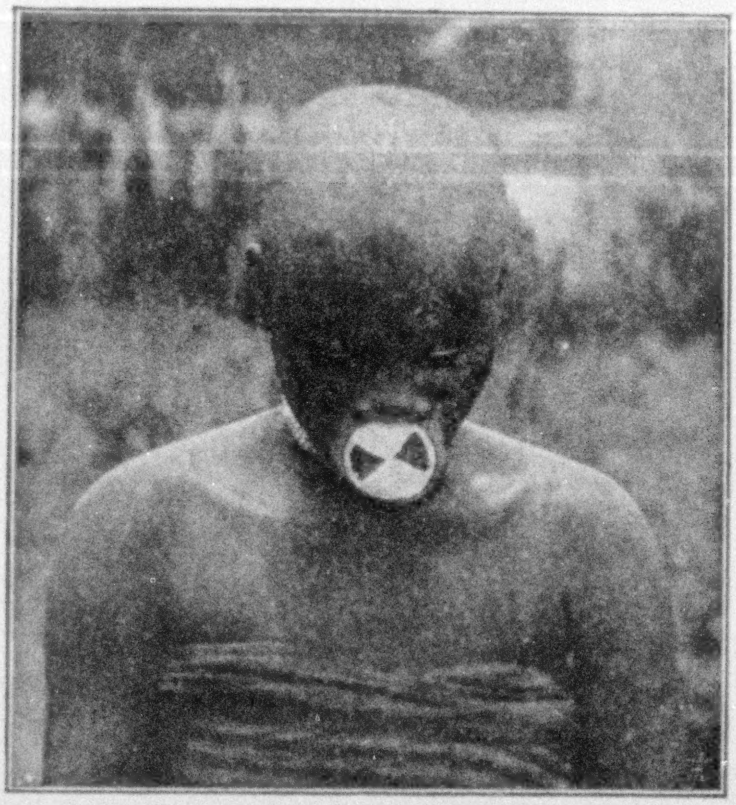


From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

A LIP ORNAMENT, CONSIDERED VERY BEAUTIFUL BY THE NATIVES

on the mountain slopes, for whom provision is made by continually burning away the dried-up grass. The young grass which shoots up from these burnt-out tracts forms a special delicacy. Stock-raising and the productivity of the country are greatly aided by the extraordinary number of small watercourses, which never run dry, even in the dry season.

From what I have written it will easily be seen that the greater part of Ruanda is eminently adapted for colonization by white men, and that cattle-raising on a large scale, and also agriculture, may be carried on in a remunerative way, for the quality of the cattle itself is as excellent as that of the milk they yield. As to the quality of the soil, it simply leaves nothing to be desired, so that it is evident that there is a splendid opening here for the establishment of business on a vast scale.

The entire region, however, is one which is quite unknown to the German government, and so it would be a very desirable thing if the state would decide upon sending out a commission, composed of agricultural experts, to examine into the conditions that exist. It would be necessary that an experienced forestry expert should be of their number, as the woods and forests question is an important one in Ruanda.

Ruanda, in conjunction with Urandi, is the most thickly peopled region of Central Africa. Its population has been estimated at one and a half millions. The great area of forest land has, however, been encroached upon by the increasing population, so as to provide sufficient space and pasturage for the cattle-rearing Watussi and for the agricultural activities of the Wahutu.

At the present day Ruanda possesses only two large tracts of forest on its boundaries: that of Rugege, to the southeast of Lake Kiwu, and the Bugoie forest country, which stretches from the northern end of the lake eastward. The remnants of ancient forests may be seen here and there on mountain tops; and, as these groves are regarded as sacred, they are therefore carefully maintained. They evidently mark the abodes of ancient tribal chiefs. The finest specimens of ficus are chiefly met with at these spots. Smaller groups of *Acacia abyssinica*—which, however, are very rare—may, says Mildbraed, be regarded as remains of pristine vegetation.

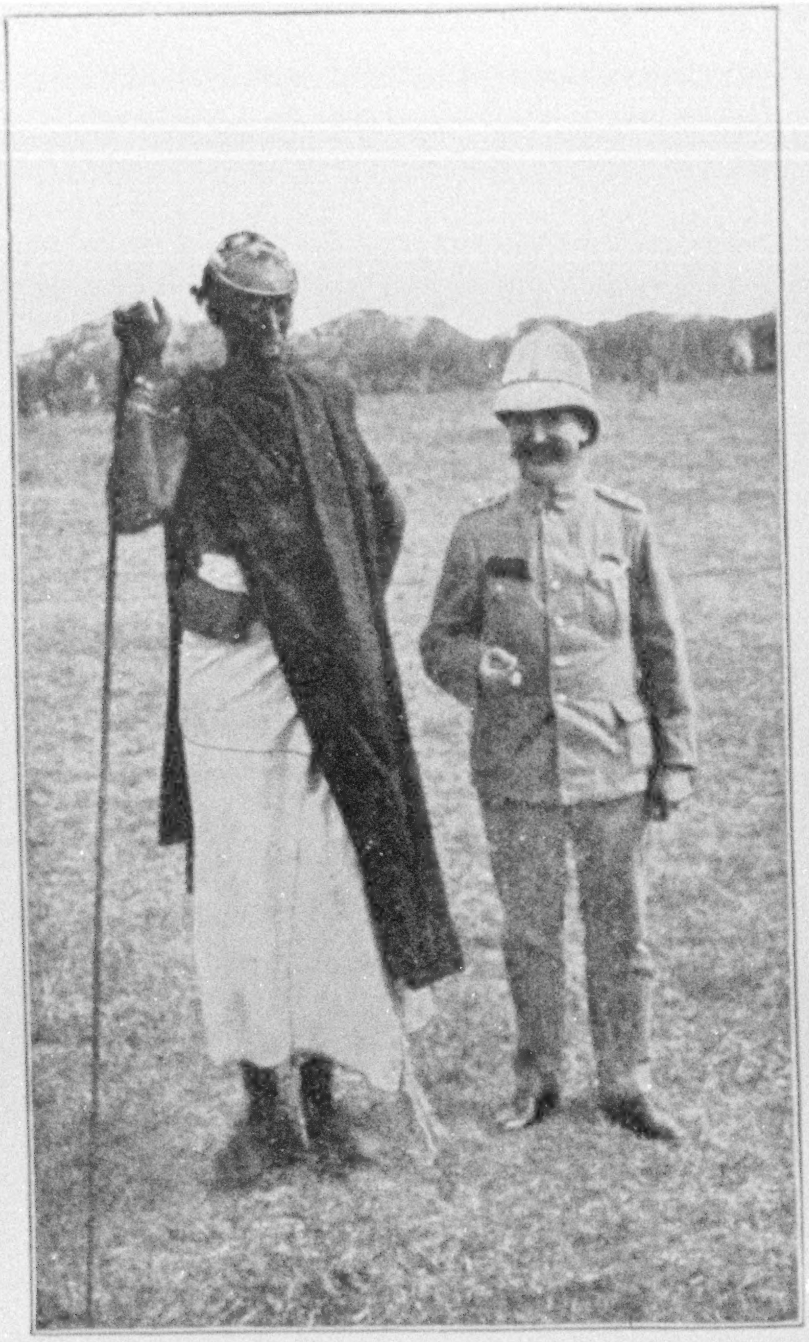
The great central portion of the country is entirely bare of trees. The question of fuel being one of the most important, as regards colonization, this matter should be inquired into at once. Time should be seized by the forelock and a judicious afforestation undertaken of those parts which most require it; for there is no doubt that we should not rest content with the railway systems already established at Lake Victoria—the gleaming rails must be pushed still farther ahead, so as to insure that we are not robbed of those rich territories lying westward of the lake.

OUR TROUBLES UNDER A BEE-TREE

On the 14th of August we set out from Lake Mohasi toward the west, our road leading us at first through the swampy end of the lake. To accomplish the passage, a huge quantity of papyrus stalks were cut and placed in layers. On this swaying but reliable foundation even the mules were able to pass across safely. Then the usual load-humping recommenced, which was a painful and laborious business at first for our carriers, after their lengthy rest.

Near the village of Katschuri, on a hill overlooking the surrounding country, there stood a mighty tree whose colossal crown of foliage seemed to invite us to a shady resting-place. Some beehives peeped out here and there between the branches, full of a promise of sweet gifts. The place seemed made for us, so we were soon lying at our ease beneath the tree's friendly shade in full anticipation of a pleasant rest after our fatigues, while the Askari set about pitching the tents.

On a sudden I jumped up, startled out of my slumber by a painful sting behind my ear, followed quickly by another on my nose. A moment later Schubotz, who had just been watching my antics with a broad grin on his face, set up a cry of woe. Wiese, muttering maledictions, fumbled about in the air with his hands, striking out suddenly this way and that.



From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

THE SULTAN OF RUANDA AND CAPTAIN VON GRAWERT, THE RESIDENT

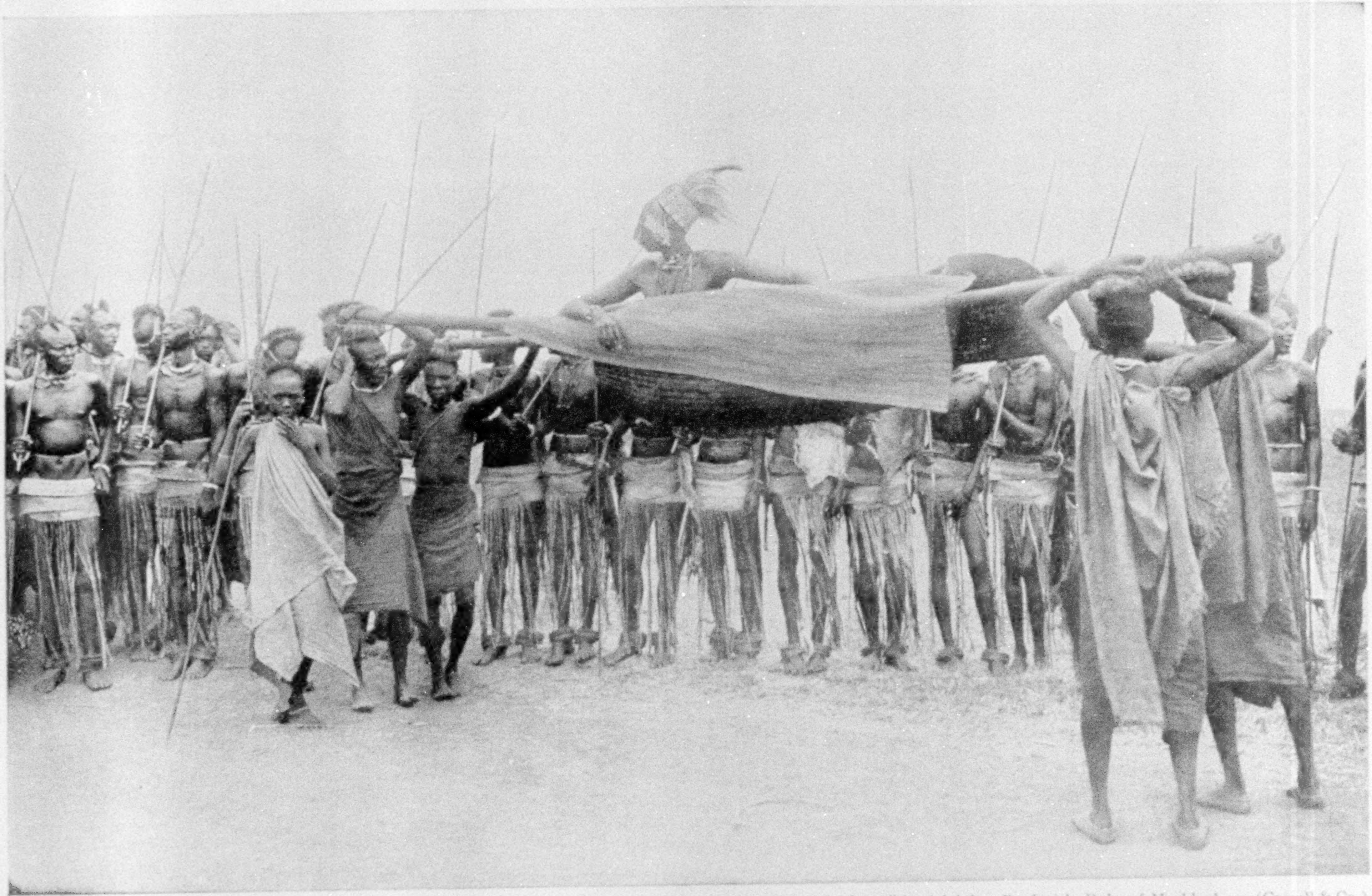
"The Sultan exceeds two meters in height (6 feet 6¼ inches)" see page 377

Then arms and cloths were waving and whisking about in every direction. "*Nyuki! nyuki!*" ("The bees! the bees!") was heard on all sides; and, just as if the swarming insects had waited for the battle-cry, the air was simply darkened by the vindictive little creatures. "Nyuki, angalia! ("Lookout!") nyuki!" The war-whoop resounded all over the camp. A fierce conflict raged for a few minutes, and then all was over.

Cries of pain were heard on all sides, and there was nothing but hurrying and scurrying and indescribable confusion. Those who endeavored to get their burdens into a place of security abandoned the effort and threw them down anywhere, and in a trice the whole crowd were flying down the hillside with the angry bees in hot pursuit. Others, and more shrewd, threw themselves down in the grass and remained motionless, and they alone were spared.

Greatly disconcerted, stung all over, and decidedly "taken down" at this shameful defeat, we met together again on the lower hillslope, where the enemy was still disputing the field. Wiese had the excellent idea of getting the Askari along and shielding their faces and hands with woolen blankets, so that the might get the loads away.

What a sight our camp presented! The loads scattered about, individuals



From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

THE SULTAN MSINGA OF RUANDA ARRIVES, BORNE ON HIS PALANQUIN OR LITTER (SEE PAGE 377) lying about here and there stretched out in the grass, the dogs howling and limping about on three legs, the fowls dead! The air was still filled with myriads of bees; they flung themselves angrily in dense droves upon the disturbers of their peace. The thick woolen armor, however, was almost sting-proof, and it was possible in a little while to bring the loads into a place of security. Yet it meant five hours' laborious work before a new camp was set up at a respectable distance from the first one. This little adventure gave us a lesson for the future. We never pitched our camp again under a bee-tree. The evening finished up with a violent thunder-storm, the first we had encountered in our wanderings.

AMBASSADORS FROM THE SULTAN BRING HUGE PRESENTS

Next morning the exhausted and suffering caravan met with a very strange surprise. A procession was descending the slope with such solemn gravity and in so calm and imposing a manner that the chattering of our carriers ceased as if by magic, and we all gazed upward, mute and spellbound.

Surrounded by a large staff of young men, two ambassadors from Sultan Msinga were slowly approaching our camp. They strode along with an indescribable self-possession and dignity, like apparitions from another world, clothed in the exceedingly picturesque gala costume of the Watussi. Bussissi and Nanturu were fine upstanding men of great height, over two meters (6 feet 6¾ inches). They brought the Sultan's greetings, and presents of numerous oxen, calves, sheep, goats, pigs, etc., and were commanded to escort us to their sovereign's residence.

The whole style and manner of their address and speech was very striking. One received the impression of being in the presence of an entirely different class of men, who had nothing further in common with the "niggers" than their dark complexion. The demeanor of our carriers, who appeared equally impressed, confirmed our view. Having received a goodly number of presents in exchange, the two emissaries placed themselves as leaders at the head of our column.

By the afternoon we reached the Niawarongo, a tributary of the Kagera, and finished our march for the day, for the crossing of the small cattle caravans, which had now increased to the size of several hundred animals, and the transport of the numerous loads lasted until the darkness fell. As the water scarcely rose above a meter, the work was simplified by forming a chain of men across the river. In this way all the loads and animals were safely passed from hand to hand, and so to the opposite bank.

We carried commissariat stores in abundance, and it was with a certain degree of anxiety that we observed day by day the increase in the number of live stock. The approach of a fresh commissariat caravan shortly after our arrival, with another reinforcement of about 30 goats, which had to be assimilated with the main body, increased our anxiety. But it would be difficult to describe our irritation when we saw yet a third caravan coming down the hill-slope with another string of 30 goats, which of course made a further inroad on our stock of barter goods. All protests against our acceptance of the gifts were quickly met with "*Amri ya Msinga*" ("By order of Msinga").

"THE GREAT OX ARRIVES WITH HIS CALVES"

The nearer we approached the Sultan's residence the larger grew the number of Watussi marching at the head of the expedition. We soon became aware that the Sultan was preparing a grand reception. In all the villages we passed the chiefs were absent, and to our inquiries as to their whereabouts we were answered by "Niansa." From all sides of the country commissariat caravans and herds of small cattle, led by Watussi, were heading in the same direction. It seemed as though the Sultan had summoned all the leading men of the kingdom to his residence. Many approached us and fell in at our van.

When acquaintances met, they greeted one another by putting their arms lightly

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

THE AUTHOR, THE DUKE OF MECKLENBURG, WITH THE TUSKS OF THE ELEPHANT KILLED ON THE SEMLIKI

Height of tusks: 2.53 and 2.51 meters (8 feet 3½ inches and 8 feet 2¾ inches). Weight: 98 and 94 pounds

around each other's waist or seizing each other's elbows. They remained in this position for a few moments. "*Amasho,*" one would then say ("I wish you cattle"). "*Amasho ngurre,*" replied the other ("I wish you women").

It can therefore easily be understood that expectation became more eager daily in our caravan. Every one looked forward to some remarkable and memorable incidents, and was impatient for the moment when he should be able to see the man whose name was a household word in Ruanda, whose word was law, and by whose sovereign will every one in the whole wide realm of Ruanda existed.

At length we reached the high-lying residence. Hundreds of Watussi advanced in front, increasing the already imposing dimensions of our caravan. A few high-born subjects were escorted by a number of carriers, bearing on their heads large baskets containing apparel and necessaries of life for the "master." Others even led a cow along with them, in order that a supply of fresh milk should be forthcoming.

Our arrival was watched from a distance, from the hill summits and elevated spots, by thousands of people, quiet in demeanor. No loud noise and clamor, no crushing throngs, as had been usual elsewhere, signalled our entrance. The behavior of the people compared most favorably with that of their kindred on the coast.

The intense eagerness with which the inhabitants of Niansa watched us, however, had also a special reason. The imagination of the people had been strongly stirred by the display of power which had been made, and which must particularly have been associated with my own personality. The immense supplies of provisions, the vast herds of cattle, which formed the presents from the Sultan, and the presence of Resident von Grawert, who came to meet us in full uniform—all this had made a tremendous impression on the minds of the people.

"The great ox arrives with his calves," flew the message from summit to summit. "He has four arms and six legs," which was meant less as a description of my personal appearance than the impression upon the pastoral mind of my power and might.

Thanks to Captain von Grawert's good offices, my camp was now most carefully and excellently laid out in a broad space not far from the Sultan's huts; for we were awaiting a visit from the "Mami."

THE SULTAN CALLS

Before "the mighty one" appeared, however, we were witnesses of a highly diverting scene. Great crowds of Wahutu had gathered round the camp. Their curiosity being aroused, they had flocked around and stared hard at the new arrivals. It was evident, however, that Msinga considered these masses of people would spoil the effect of his approach, for suddenly two forms clothed in red togas appeared upon the scene, staring fiercely at the crowd and swinging long staffs round their heads with very unmistakable intent, and they whirled them recklessly, with their full strength, into the midst of the people.

But the latter were apparently familiar with this maneuver, for at the same moment that the staff-bearers began to swing their weapons over their heads the whole mass was off in wild flight, and only a few laggards were struck. The square was empty in a trice. A few of the most curious, who ventured to return, had stones flung at them to drive them away.

A moment later the rolling of drums was heard from the palace, and then we were spectators of a unique drama, such as could only be enacted far from the beaten path of the ordinary traveler.

The splendid figures of the Ruanda princes, with their sons, marching in pairs, headed the procession. Msinga's palanquin, which then left the gate of the residence, followed slowly. Every one wore festive apparel, similar to that in which Nanturu and Bussissi had appeared. Their bodies were naked, but their hips were wound round by a narrow loin-cloth of tanned cowhide in two transverse folds, from which a number of strings of otter-skin or cowhide fell down to the ankles, which in their turn were adorned with various metal rings. On their heads were hair-combs reaching from ear to ear, in which a thin pearl chain lay gleaming. Long yellow strings of banana hemp hung down in a copious mass from their necks to their breasts, on which pearl ornaments of varying sizes, called *mitako,* were fastened. Their wrists were encircled with bracelets of copper wire and glass beads of various color.

Thus the train approached my tent with measured steps and quiet, dignified demeanor. Our guard of honor for the Sultan—a non-commissioned officer and two men—presented arms. The Sultan's litter, a long, simple basket, the bamboo rods of which rested on the shoulders of Batwa people, was carefully lowered, and with the German words "*Guten morgen, Euer Hoheit,*" Msinga stretched out his hand to me.

The Sultan's figure, a little rounded in contour in consequence of his easy manner of life, exceeds two meters in height (6 feet 6¾ inches). One searches vainly at first for an expression of his vaunted intelligence, and an eye defect, coupled with strongly protruding upper teeth, emphasizes the unfavorable impression. Yet the questions which he addressed to me, and to those standing round, while reclining near me in a long chair, touched on the most various spheres of interest and bore witness to his keen, logical power of thought.

AN ENDLESS SUCCESSION OF GIFTS

After a lengthy conversation, which was carried on in the Suaheli tongue, and which touched on many topics, Msinga begged to be allowed to deliver his presents to me. This was a moment of great political importance and keen suspense to Msinga and his friends, as well as to his enemies, as the refusal of any portion of such presents would be a sign on my part that I was desirous of assisting the pretender to the crown, a relative of Msinga's, and that I wished to overthrow the reigning "Mami."

A tremendous gathering of people had therefore assembled behind the chairs on which we were sitting with the Sultan, as well as opposite them, forming a lane, and awaiting the appearance of the gifts with painfully subdued excitement. And they came—came in endless succession.

In front was a milch cow, whose calf was carried behind. She was intended to represent the greatest honor that could befall me. She was followed by 10 oxen, with immense horns, and then a never-ending herd of goats. Flock followed flock, fresh contingents constantly rolling up and overflowing the cantonment. They were succeeded by an endless chain of heavy-laden Wahutu, with hundreds of loads, consisting of meal, milk, honey, butter, beans, and bananas.

After them appeared other trains bearing firewood, which was rare in the neighborhood and therefore particularly valuable. All these treasures were stored away in the camp, but the stock were driven into a hedged enclosure and placed under the guardianship of an Askari patrol. The procession had taken nearly an hour to pass by. Von Grawert himself, in spite of his lengthy term of office as Resident, declared that he had never before witnessed such an imposing spectacle.

WE DELIGHT THE SULTAN WITH A SAW

The great and overwhelming fear of a refusal of the gifts having passed, Msinga's court breathed freely again. The visit was at an end, and with solemn farewells the sovereign entered his litter and was borne away, followed by a forest of 500 spears. An ineffaceable impression!

The return visit in the afternoon was conducted with as much splendor as it was possible for a traveling caravan to offer. In addition to the ordinary gifts of stuffs and beads customary in the country, others were specially selected with the hope of "lightening up the countenance of the ruler" and rejoicing his heart. Any real equivalent to his own gifts was of course impossible.

Preceded by Askari with flying flags, followed by all the "boys," each carrying a present in his outstretched arms, and with horns blowing, we entered the Sultan's courtyard, which is brightly and cleanly kept, and passed on to the palace, which is bordered round by a hedging of wickerwork and papyrus. After an interchange of the customary greetings, and when we had taken seats, the presentation of our gifts took place. In order to heighten the effect, we ordered the "boys" up singly with their presents, so that they might be displayed to the best advantage.

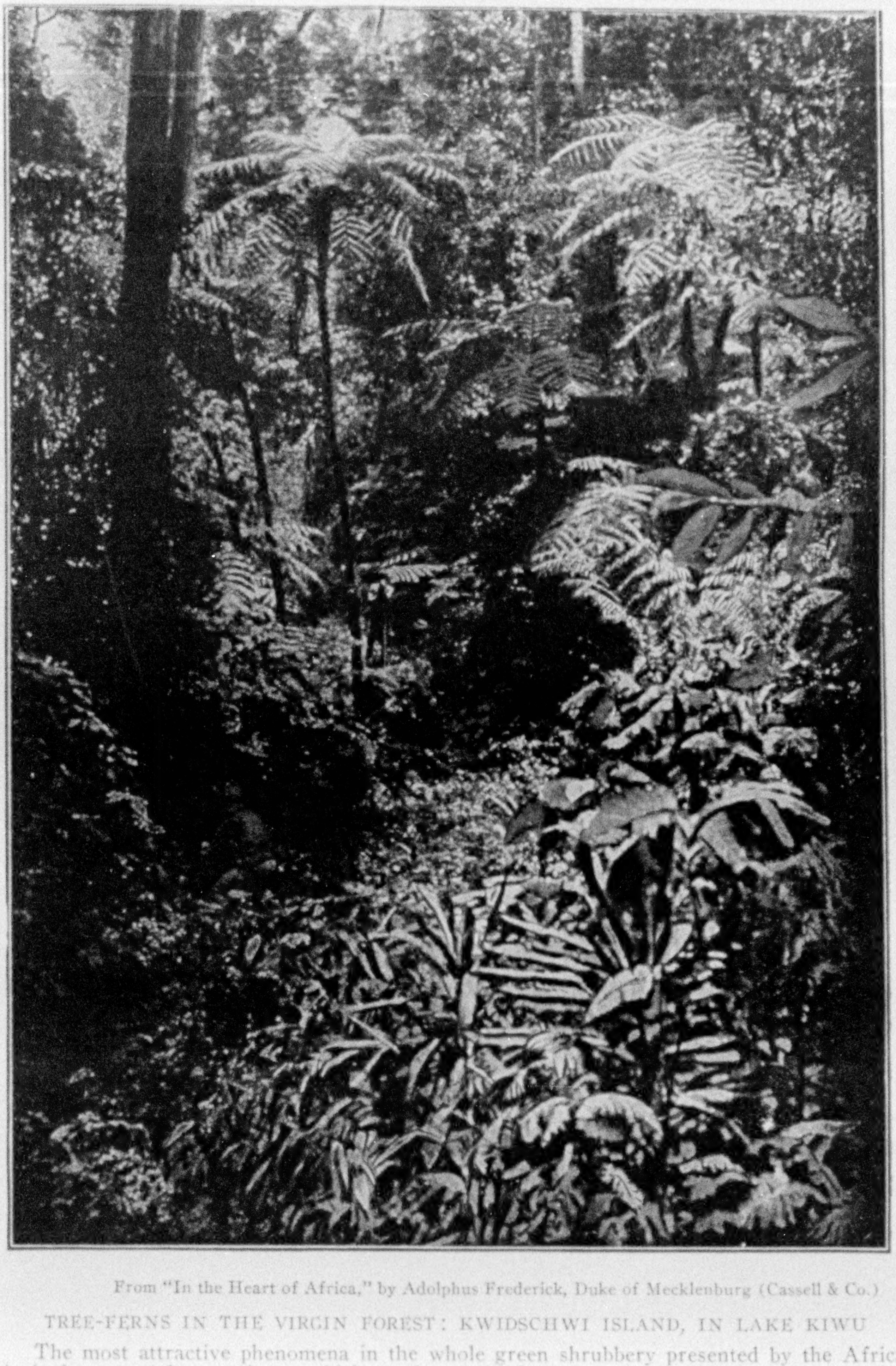
The ordinary presents did not in the least excite the attention of the potentate; they were put aside with indifference or divided immediately amongst his head men. The clanging of an alarm clock, which had to be explained in every detail, pleased Msinga rather more, and his satisfaction grew into rapture when I handed him my hunting knife and a cartridge pouch filled with ammunition to fit the sharpshooter rifle which had been lent him.

But his enthusiasm reached its climax when I, with much solemnity, presented him with a saw, for which he had specially asked. After a few failures, he succeeded in sawing away the legs of my chair and operating upon everything else within reach with fairly good results. The "ministry," too, watched the experiments with the liveliest interest. The Askari, who were put through their drill and evolutions, gave considerable satisfaction, and this was heightened by the firing of a few rapid volleys.

THE REMARKABLE JUMPING OF THE WATUSSI

The following few days were devoted to sports and athletic exercises, of which the high jumping of the young Watussi was a most remarkable feature.

A line, which could be raised or lowered at will, was stretched between two slender trees standing on an incline. The athletes had to run up to this and jump from a small termite heap a foot in height. Despite these unfavorable conditions, exhibitions were given which would place all European efforts in the shade. The best jumpers—slender, but splendid figures, with an almost Indian profile—attained the incredible height of 2.50 meters (8 feet 5 inches), and young boys made the relatively no less wonder-

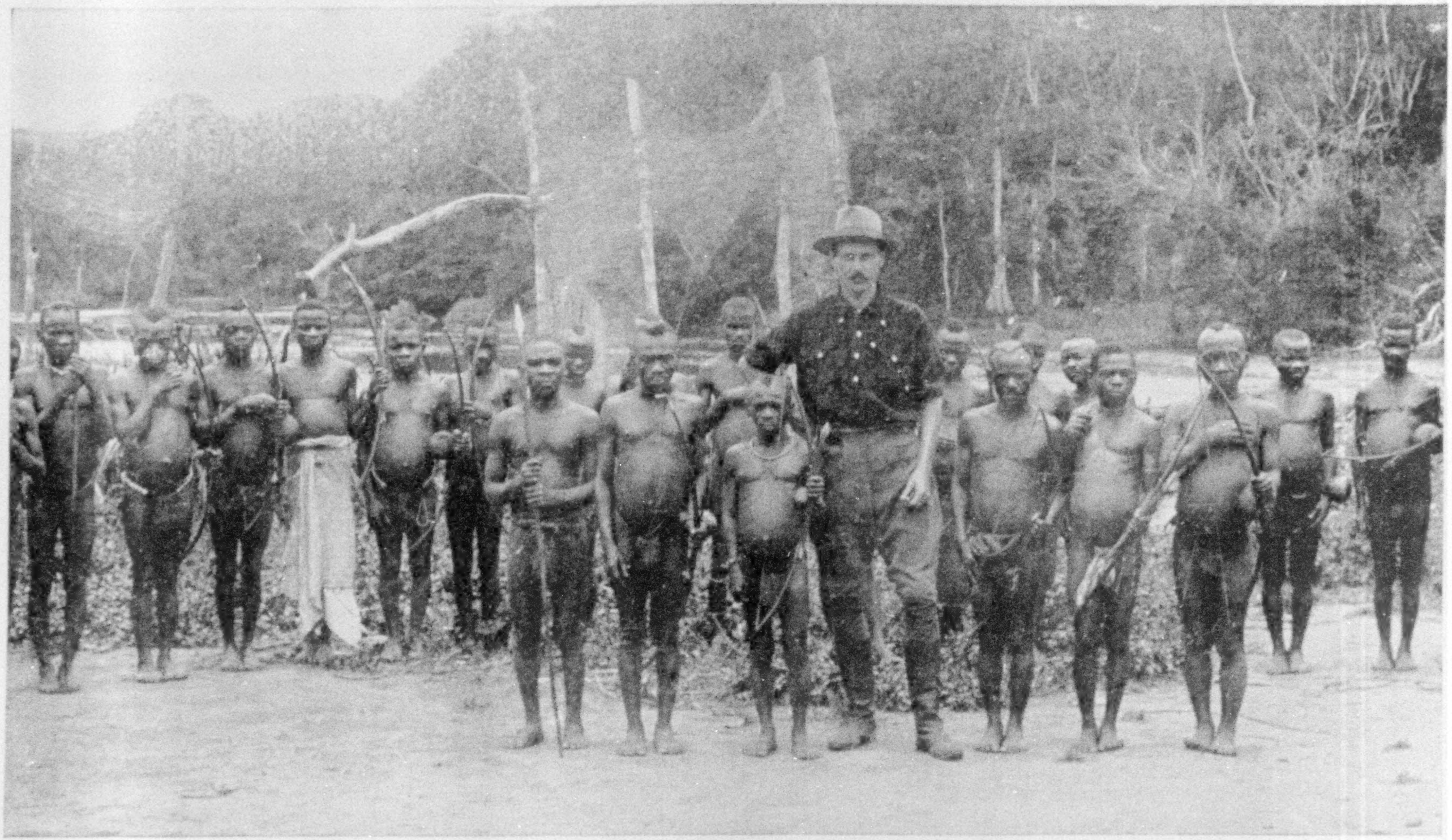


From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

TREE-FERNS IN THE VIRGIN FOREST: KWIDSCHWI ISLAND, IN LAKE KIWU

The most attractive phenomena in the whole green shrubbery presented by the African virgin forest are the tree-ferns, which are found chiefly in clumps close to small watercourses. They are perhaps the most beautiful children in Africa's flora; with their slender stems, ten meters and more in height, and beautiful crowns, they are more like palms than ferns, and no layman would recognize in them a relation of our common bracken fern. The luxuriance of the undergrowth corresponded with the richness in species and variety of the lower animal world. . . . Earthworms of more than 40 centimeters in length, and fully as thick as one's thumb (*Benhamia* spec.), were extremely common. . . . The most striking feature, however, was the wealth of butterflies in this forest.

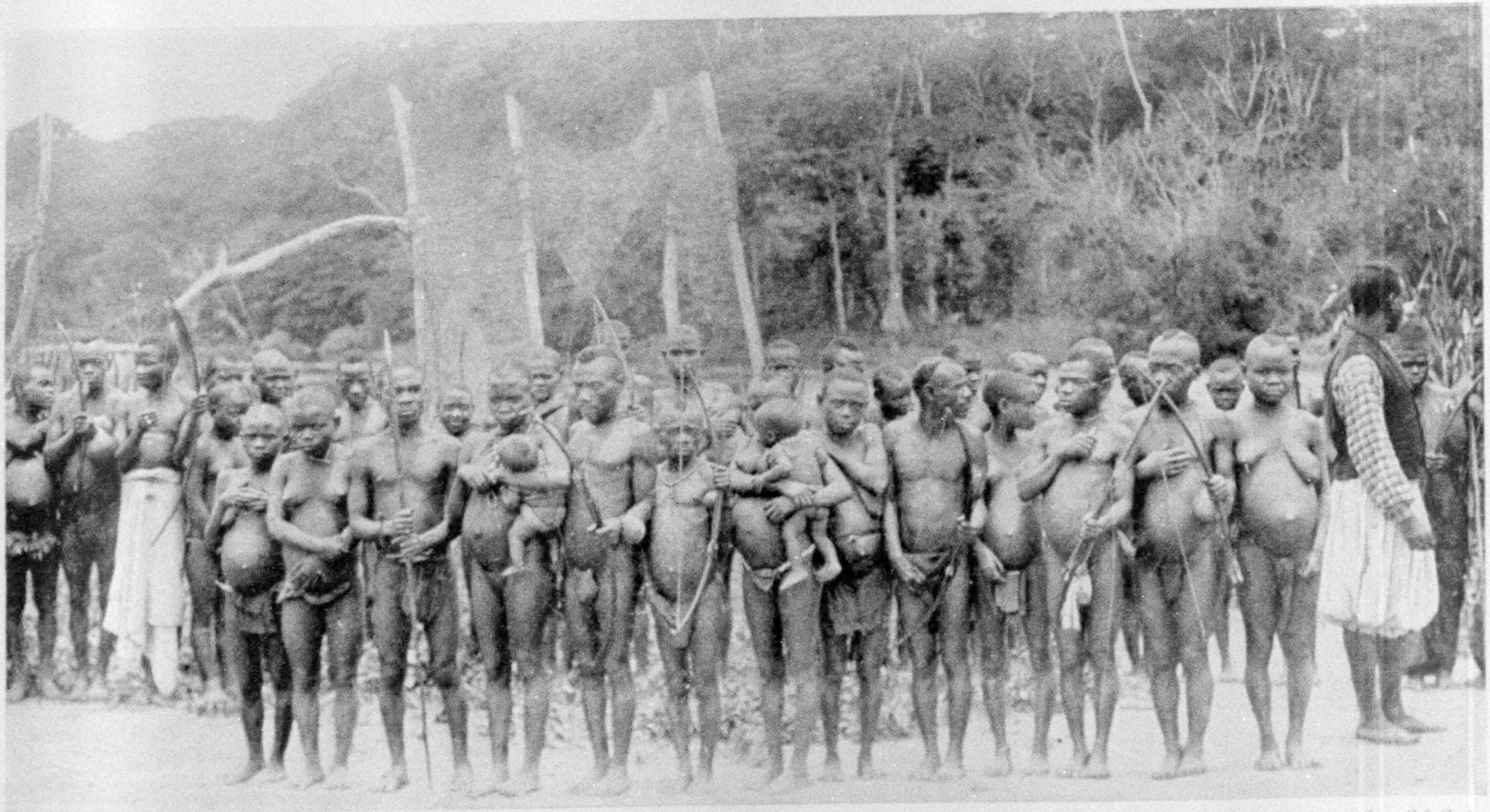
XUM



From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

PYGMIES OF THE GREAT FOREST, NEAR THE SEMLIKI RIVER

The pygmies are compact and strong in build; are very muscular; have round heads and short, curly hair. Big, intelligent eyes gaze out from good-humored faces. Their clothing consists of an apron of gray, woolly, beaten bark, which is obtained from the supa tree, and fastened round the loins with a belt of grass cord. Their place of residence changes according to their whim or hunting conditions, but is never to be found outside the forest boundary. The huts are carefully built of liane, covered over with foliage, which is scarcely proof against beating rain.



From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

PYGMIES OF THE GREAT FOREST, NEAR THE SEMLIKI RIVER

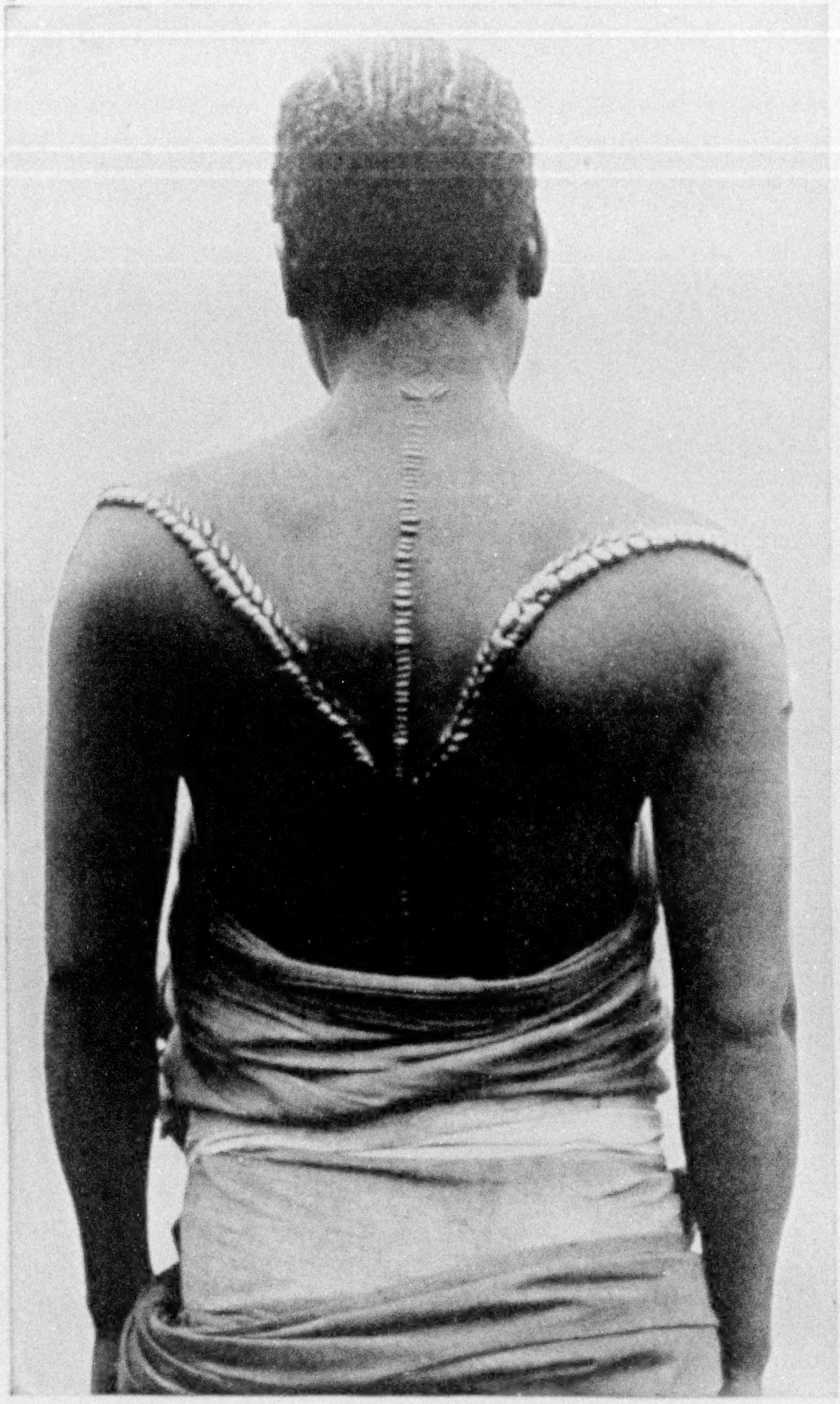
The weapons of the Wambutti consist of a bow and arrow and a short spear. According to their uses, whether for war or for hunting purposes, they are made of iron and wood respectively. The men forge or carve them themselves, and the arrows are all tipped with vegetable poison. From researches made by Dr. Max Krause, of the Berlin Hydro-Therapeutic Institute, it appears that the poison in these arrows is derived from a species of *strophanthus*, most probably *hispidus* or *kombe*, not *gratus*. After removing the poisonous coating for the purpose of investigation, it was found that the arrow was notched about three centimeters from the point, so as to favor its breaking off in the wound. The poison works rapidly, and is fatal in its effect unless the arrow-point is withdrawn very quickly and the wound sucked dry. Big game always succumb to its effects; death follows more or less swiftly, according to the particular position of the wound.

ful performance of 1.50 to 1.60 meters (5 feet).*

With Weidemann's assistance, I was enabled by means of an excellent cinematograph apparatus to obtain a few capital pictures of these noteworthy performances, and their reproduction in Germany aroused great interest.

Prizes in the shape of "gold" chains and similar objects were then distributed. The "Tait diamond" ornaments, which I had brought with me as special gifts of honor, found great favor with the trinklet-loving Watussi. Rings, stars, brooches, etc., were at length so coveted that my tent was in a continual state of siege, and I was obliged to keep my admirers at arm's length, so as not to exhaust completely my stock of "precious jewels."

We were also given an opportunity of seeing a set of dances, which differed in no material respect in their character from those I had watched in the Masai steppe and among the coastal tribes. There was no musical accompaniment to the majority of the 11 different kinds of dances which we observed, such as is usual with all the terpsichorean exercises of the negro people. In spite of this, however, there was no lack of rhythm. These dances were based on ideas borrowed from the animal kingdom, and were executed singly or in groups accordingly.



From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

CICATRISATIONS ON A MKONDJO WOMAN

The study of the tattooings and skin-markings found in the whole of Central Africa is an extremely remarkable one. It demands very great diligence and very special and detailed investigation to trace the origin and significance of the custom. For instance, Wiese found patterns which constantly recurred, but were frequently accompanied by changing side-marks among the hundreds which he copied. According to the statements of the natives, they betokened signs of lineage by which the various races recognized their own folk. The ornamental scarrings are brought about by an inflammation or artificial irritation of the skin, which is scratched or incised with a knife, according to the pattern desired. The wounds are smeared over with vegetable matter and dirt, which causes them to swell up to an extraordinary extent. We saw skin-puffings on the foreheads of the Bangala, the chief race of the Middle Congo territory, swollen up to about two centimeters Countless variations may be found among which the half-moon shape occurs most frequently.

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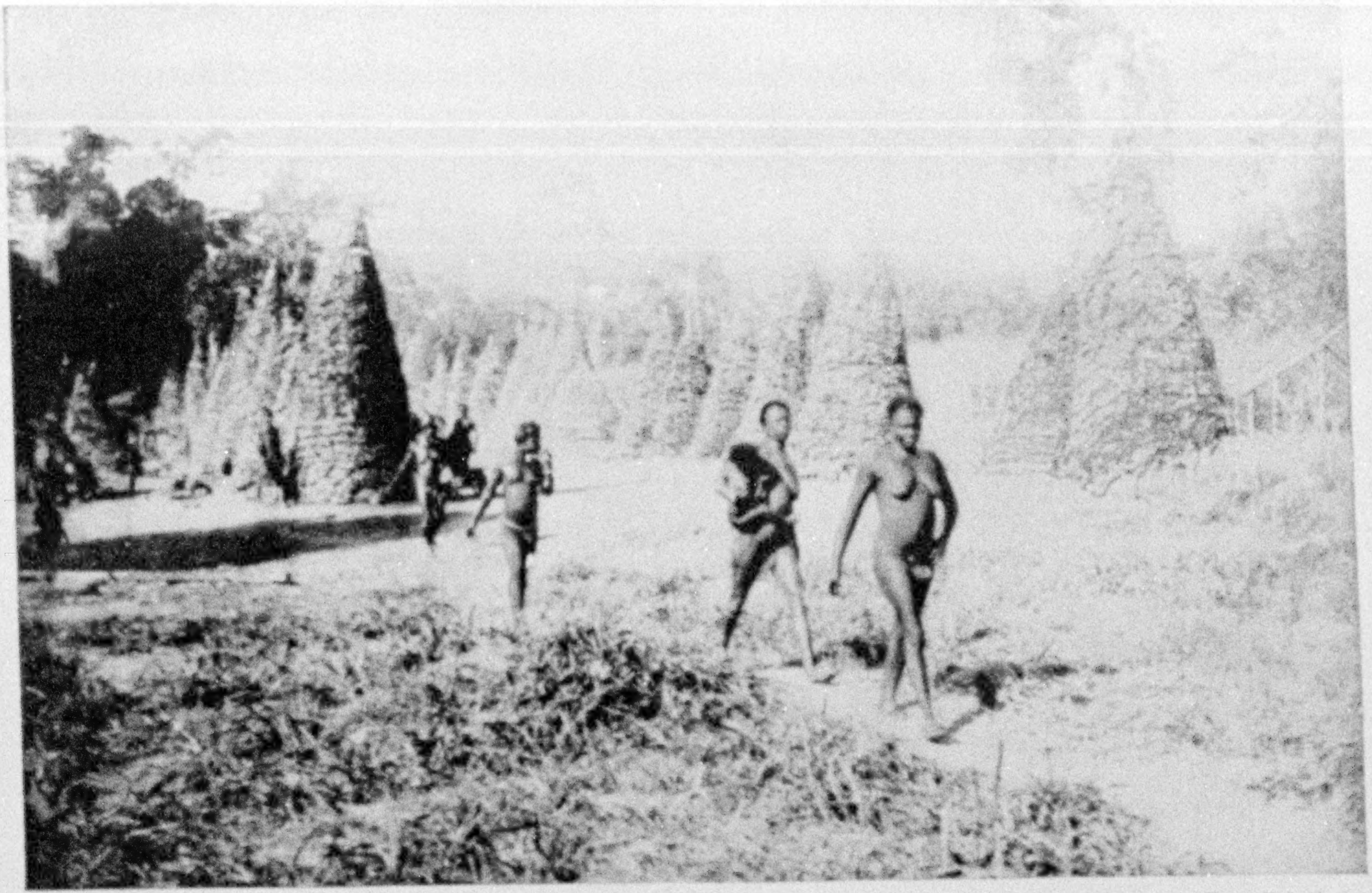
*The world's record for a running high jump is 6 feet 5⅝ inches.



From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

CONICAL HUTS OF THE WANGILIMA, ON ONE OF THE HIGHER TRIBUTARIES OF THE CONGO

I remember one dance, which was designed to illustrate the movements of a crane. We smile, no doubt, at these naïve native customs, but quite unjustifiably. We come across the same ideas in our highly cultured Europe, for what is the clog dance of the Upper Bavarian peasants but an imitation of the song and motions of the blackcock?

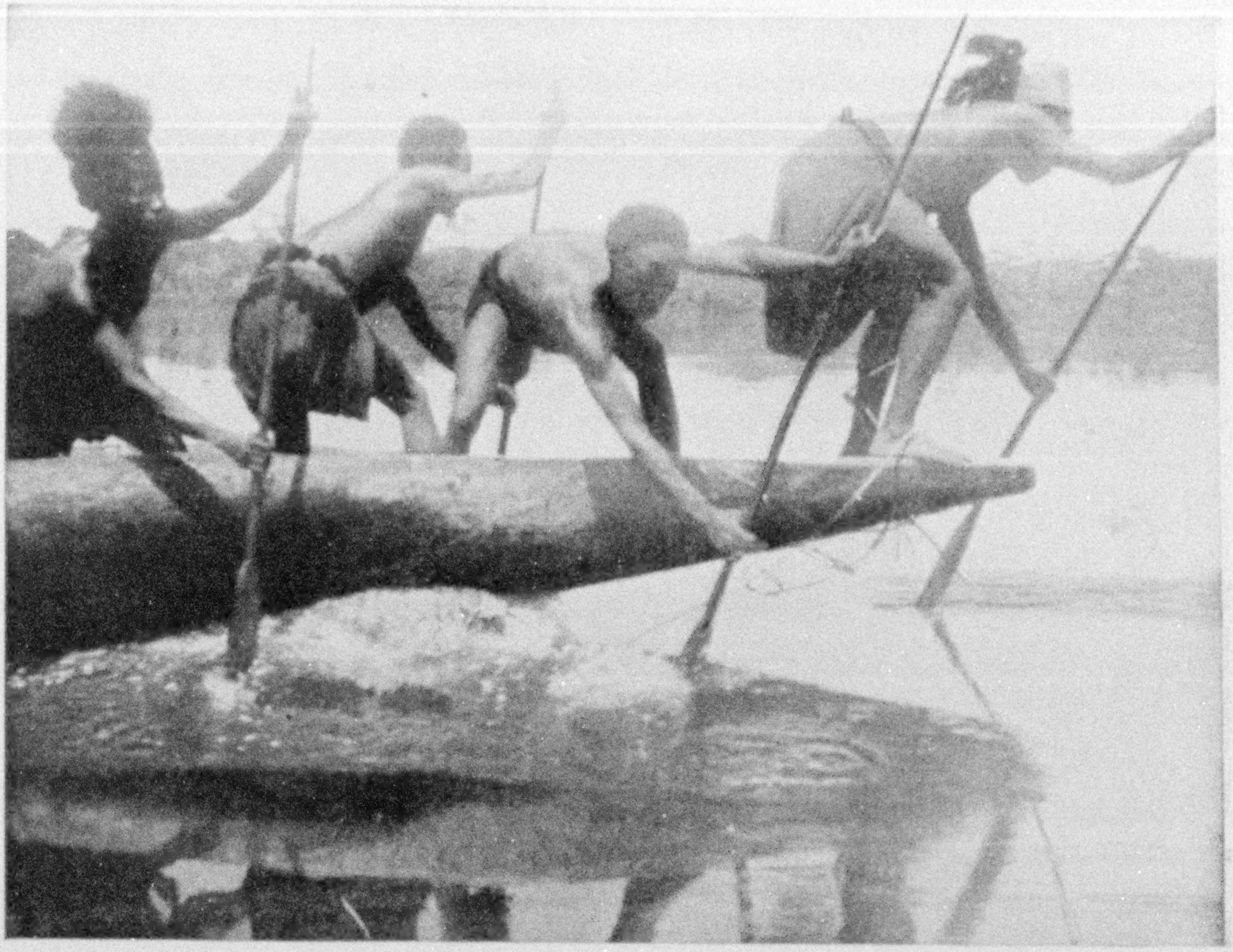
The war-dances, however, were of a different nature. These were carried out in groups, and we were able to distinguish different phases. Two parties would rush to attack each other, brandishing long rods and spears. Then a number of warriors would dance in a circle around a man who was bounding into the air with his arms held close to his body. Yet the movements were never wild; they never degenerated into those grotesque leapings and war-cries, or cadenced groans, so often met with among savage native tribes, but were always measured and dignified.

Each of the dances had been well practiced in the presence of one of the great chiefs. The Sultan himself had assumed the stage management of the joint dances of the chiefs. At the conclusion of each new phase, he never omitted to question me as to which group had best satisfied me, and I took good care that my replies should be as agreeable as possible to the ears of the ruler.

JAVELIN AND ARCHERY CONTESTS

Then a number of young Watussi exhibited their remarkable skill in javelin throwing. Taking a run of ten steps, bending backwards almost to the ground, they hurled their javelins up to almost prodigious heights, and with such impetus that two of the spear-shafts broke in the air from the vibration. It was the same with the shooting-matches with bow and arrow, in which the trunk of a banana tree was used for the butt. The shooting average at 50 meters was really good.

Great strength is required to bend the bow correctly, and to draw it to its fullest extent long years of practice are necessary. The elasticity of the bow, which is from 1.30 to 1.50 meters in



From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

OARSMEN ON ONE OF THE UPPER TRIBUTARIES OF THE CONGO (FIRST POSITION)

These men were recruited from the Wabudu and Wangilima tribes—fine men, whose splendid display of muscle afforded evidence of perfect training. Their naked bodies shone with grease. They wore caps on their heads, made from the long-haired skins of apes, or tightly fitting bonnets smeared with grease and camwood, something like those used by our ladies at home when bathing.

height, is extraordinarily great, and with the bow-string drawn to its fullest extent the arrow flies a distance of 200 paces.

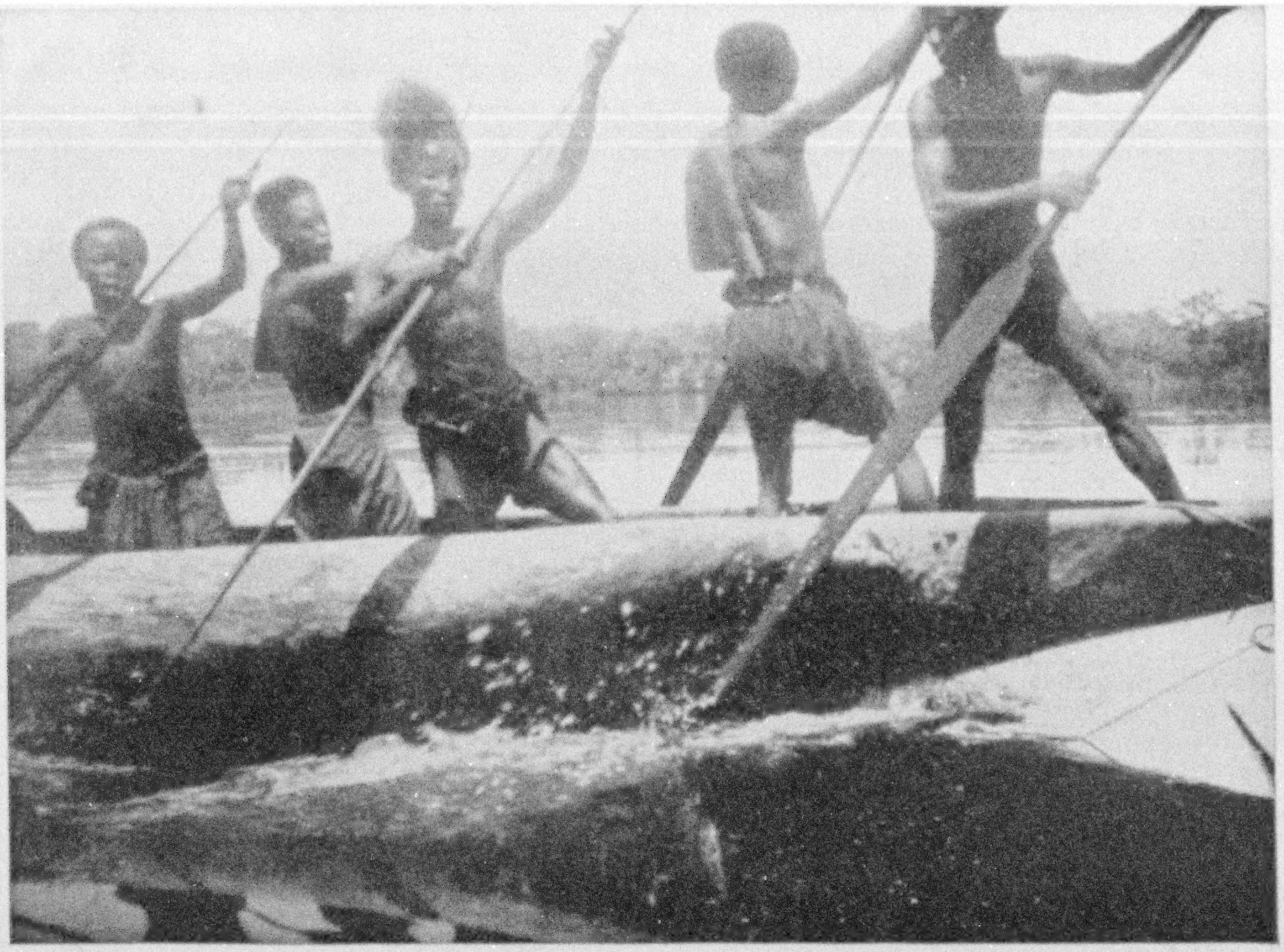
Running races, too, were organized, but owing to the lack of the necessary measuring instruments I am, unfortunately, not in a position to give the times. I have no doubt, however, that in this department, also, the European records were at least equalled.

IT IS NOT GOOD FORM TO LAUGH

The effects of a gramophone performance were curiously varied. Some listened and presented a most stoical indifference; others opened their eyes till they were as large as saucers, and the faces of others, again, were convulsed with delight. We had occasion here to confirm our former impressions namely, that our military marches aroused no interest, that unintelligible interlocutions caused general amusement, and that songs in a female voice, especially when they attained the higher notes, excited screams of laughter.

Laughter, however, was a slight source of trouble to the Watussi. It was not supposed to be "good form" to laugh, and it was intensely diverting to watch the frantic efforts made to conceal it, hands being placed quickly over mouths in order to hide any indiscretion. Then, after the merriment had passed, the delinquents would gaze quite gravely at the gramophone horn, until a suspicious twitching at the corners of the mouth rendered a fresh maneuvering of hands necessary.

The crowd continued to grow denser



From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

WANGILIMA OARSMEN (SECOND POSITION)

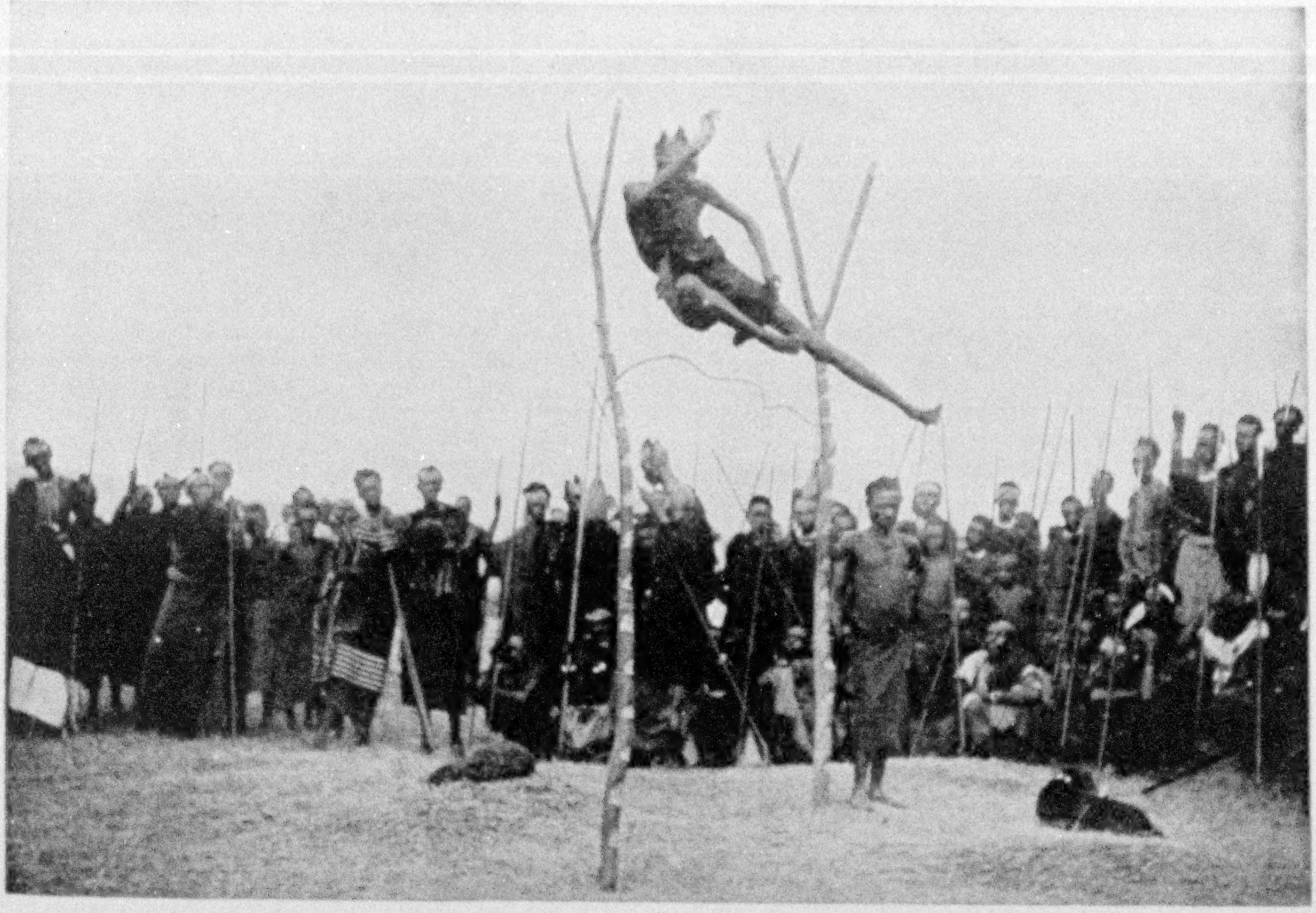
Bending down low, the rowers dipped their finely carved copper-decorated paddles deep into the water, pulling them out again with a peculiar rapid jerk which made the canoe vibrate a little. The men are excellent, hardy river boatmen, who, with some encouragement, will persevere untiringly for hours at their work. While paddling they usually sing melodiously and with a purity and harmony of tone that I have seldom met with elsewhere. We all found this agreeable mode of traveling an indescribable relief after our exhausting marches through the primeval forest. Lounging in *dolce far niente* style, stretched on a comfortable chair under the protecting awning, we saw most luxuriant sylvan scenery pass before us in an ever-changing panorama. The boat we used was the common dugout canoe, and bore 20 oarsmen.

round the instrument, for the safety of which I was beginning to become nervous, when his serene highness suddenly hurled his long staff into the arena, making the splinters fly and ending the séance.

The Sultan being also desirous of seeing the white men do some shooting, an iron pot was placed on a stake and set up at a distance of 150 meters. As I, as well as others of my company, was successful in hitting this tolerably easy mark several times in succession, the plaudits from the crowd were great, and innumerable hands were stretched out in congratulation.

The Sultan, fearing that he would be beaten if he tried his skill from the same point, approached within 50 paces of the mark. His efforts were not exactly brilliant, yet every company captain would have been delighted with the faultless way in which he made ready and the precision with which he carried out all the movements. He was like an infantry man at the rifle butts.

The Sultan made me a further present of several objects of native industry. Yet the purchase of ethnographical material met with obstinate opposition. However, after some persuasion, Msinga gave his permission for goods to be bartered, and forthwith the whole population hastened from all quarters to enrich themselves by high prices for their wares. It



From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

HIGH JUMP BY A WATUSSI (SEE PAGES 378 AND 382)

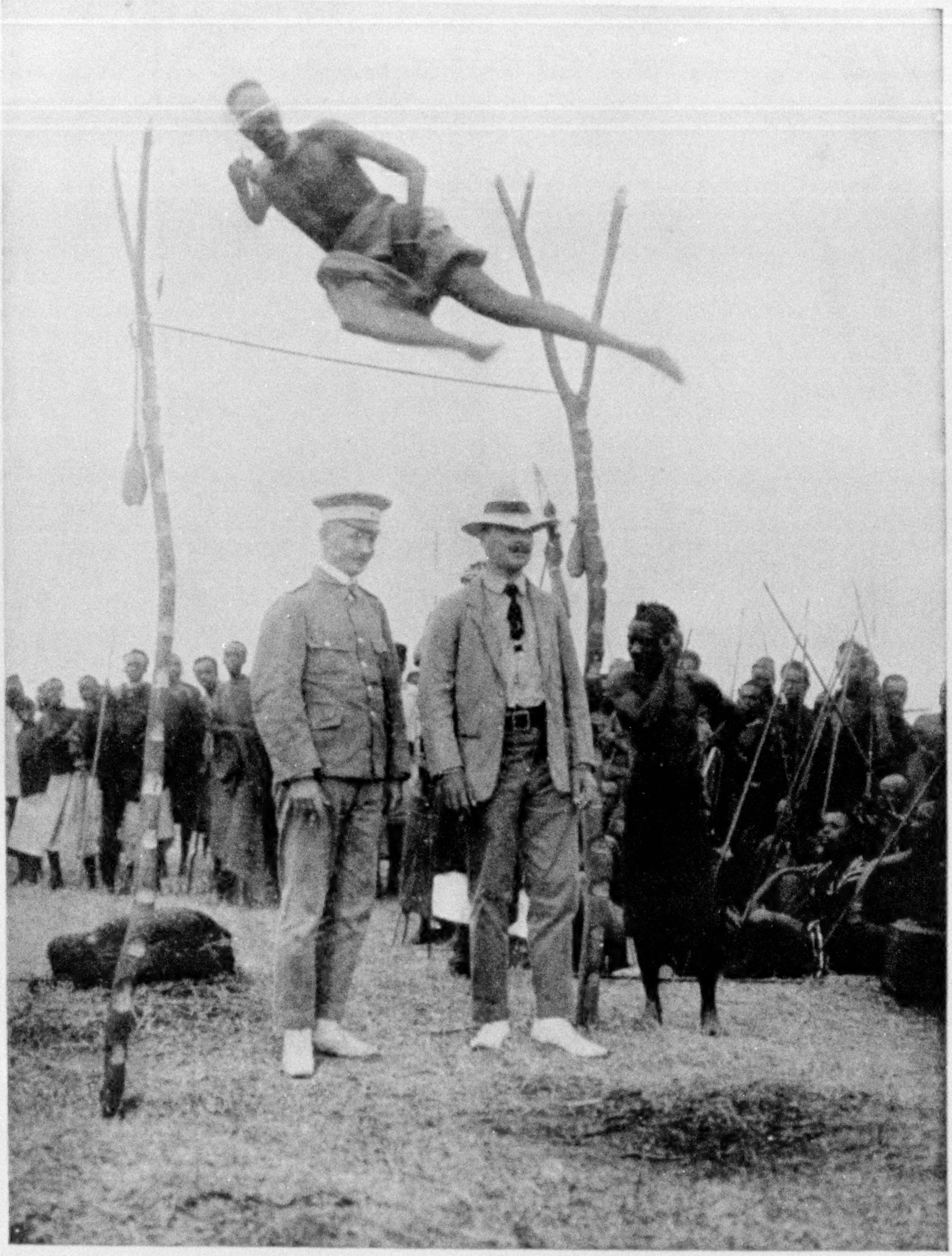
was principally through Wiese's efforts that we were enabled to get together a Ruanda collection such as has never before been seen in Europe.

At Niansa we received a visit from Father Class and Father Dufays, of the mission station of the White Fathers, who came along in company with Dr. Czekanowski. Long years of intimate intercourse with the natives enabled them to give us much valuable information relative to the inhabitants of Ruanda. The day before they had paid us a very delicate attention in the shape of a most welcome parcel of fresh tomatoes and vegetables. This was a great treat, our enjoyment of which could not be adequately appreciated save by Europeans who had suffered, like ourselves, from long deprivation of such luxuries.

If we were going to fulfill satisfactorily the various tasks we had set ourselves, it was now high time that we were once more on the move. So we resolved upon an early departure.

The most singular fact associated with our visit was that we never once came face to face with a Watussi woman. It appeared that they had been carefully guarded in their huts the whole of the time, so that they might not meet the eye of any of the "whites."

When we took our leave of the Sultan, at early dawn on the 12th of August, it was with a certain amount of satisfaction. We had been afforded an insight into the court life of a negro prince and favored with a display of his power such as no one had ever experienced previously or would probably ever experience again. When the illimitable power of this Sultan has receded before European influence, and when busy throngs of traders encroach upon the haughty aloofness of this most aristocratic of all negro tribes and the white man's herds graze in its pastures, then we shall be able to appreciate to the full the value of our remarkable experience.



From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

THE CHAMPION HIGH JUMPER OF AFRICA (SEE PAGES 378 AND 382)

"A line, which could be raised or lowered at will, was stretched between two slender trees standing on an incline. The athletes had to run up to this and jump from a small termite heap a foot in height. Despite these unfavorable conditions, exhibitions were given which would place all European efforts in the shade. The best jumpers—slender but splendid figures, with an almost Indian profile—attained the incredible height of 2.50 meters (8 feet 5 inches), and young boys made the relatively no less wonderful performance of 1.50 to 1.60 meters (5 feet)."

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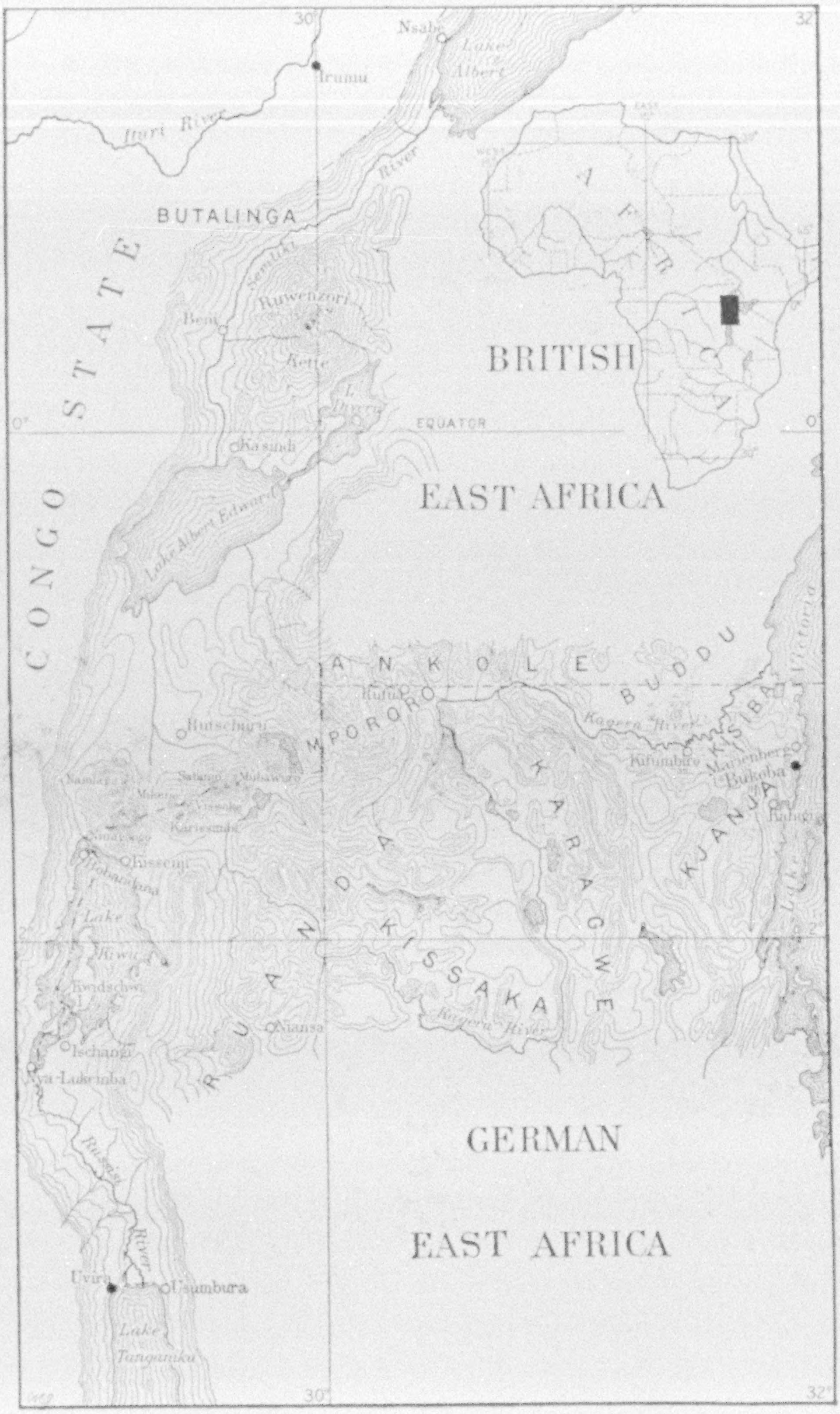

30°
32°
Nsabe
Lake Albert
Irumu
Ituri River
River
BUTALINGA
CONGO STATE
Semliki
Ruwenzori
Beni
Kette
L. Dweru
AFRICA
BRITISH
EAST AFRICA
0°
EQUATOR
0°
Kasindi
Lake Albert Edward
ANKOLE
BUDDU
Rufua
MPORORO
Kagera River
Rutschuru
KISIBA
Victoria
Marienberg
Kifumbiro
Bukoba
Namlagira
Mikeno
Sabinjo
Mubawuro
Vissoke
Kariesimbi
Ninagongo
Kissenji
Rubaetschaua
Lake
Kiwu
KJANJA
KARAGWE
RUANDA
KISSAKA
Kagera River
Kwidschwi
Niansa
Ischangi
Nya-Lukemba
Rusisi
River
Uvira
Usumbura
Lake Tanganika
GERMAN
EAST AFRICA
30°
32°

OUTLINE MAP OF RUANDA, "THE LAND OF GIANTS AND PYGMIES"

North of Ruanda rise eight gigantic volcanoes, which bear testimony to the mighty subterranean forces concealed beneath. Namlagira and Ninagongo are still active, and are the most interesting of this remarkable group. Dauntlessly their colossal forms tower up to the skies, 14,500 feet above sea-level, and not infrequently one sees the dazzling snow on their highest peaks gleaming under the tropical sun, only 100 miles from the Equator.

THE CORONATION OF HIS MAJESTY KING MAHA-VAJIRAVUDH OF SIAM

By Colonel Lea Febiger, U. S. Army

LAST December I had the pleasure of visiting Bangkok, the capital of Siam, as the military representative of the United States at the coronation of His Majesty King Maha-Vajiravudh. From nearly every nation of Europe there were special representatives. Members of the royal families of England, Denmark, Sweden, and Japan headed the legations from those countries. Our own Minister and those of several other countries were created ambassadors extraordinary for the occasion.

The actual coronation occurred Saturday, December 2, but was preceded the day before by a most interesting and gorgeous function at the Wat Phra Keo, the holy Buddhist temple within the palace grounds (see illustrations, pages 396 and 397). All woodwork inside and out of this temple was covered with gold leaf, and the walls were a glittering mass of colored bits of glass set in the stucco in designs. This ceremony was the blessing of the holy water to be used for the coronation, and was attended by all the court and diplomatic corps in full regalia.

The inside of the temple was so filled with priests that only members of the royal families, native and foreign, and heads of legations could be accommodated within, so the suites had seats on the entrance portico. They made a most resplendent aggregation of foreign uniforms and rich native costumes, those of certain native princes having over them a filmy lace coat heavily embroidered with gold.

This was our first view of the King. He wore a general officer's uniform, and was preceded by a number of lictors, or gentlemen in waiting, clad in quaint uniforms of light blue and silver, with a head-covering shaped like the ancient Tyrian cap. He was followed by a full hundred aides-de-camp in various glittering uniforms, the guards remaining outside the portico.

The coronation took place in the Dusit Maha Prasath Hall of the Chakkri Palace. This hall is shaped like a Maltese cross. The throne was at the intersection of the arms, all the foreign and native notables being assembled therein.

A few minutes before 12 o'clock His Majesty appeared, conducted by court chamberlains, and took his seat upon the throne, and at high noon, amid salvos of artillery and cheers from the populace outside, placed the crown upon his head with his own hands, having received it from his uncle, the Patriarch of the Kingdom.

After prayers by the Brahmin priests present, he received the homage from the various classes, each being represented by one member—the royal family first, then the military, civil officials, and members of the household. He then proceeded to the balcony to receive the homage of the lesser officials assembled without in the courtyard.

The King was dressed in a red uniform, profusely decorated with orders, and covered with cloth-of-gold draperies. The filagree golden crown was in the shape of a "prachidee," the tapering steeple with broad, round base, seen all over the land in connection with "wats," or temples (see illustrations, pages 394 and 395).* His Majesty then proceeded in state to the Wat Phra Keo, where he declared himself defender of the faith (Buddhistic) in the presence of the 80 chief high priests of the Kingdom. The priests presented an address and again blessed His Majesty.

This state procession was a most gorgeous, oriental, and dramatic pageant, well shown in the photographs, except that the startling and effective combinations of colors cannot be reproduced. The musicians were grouped by instru-

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*See also illustrations in March, 1912, number of The National Geographic Magazine.

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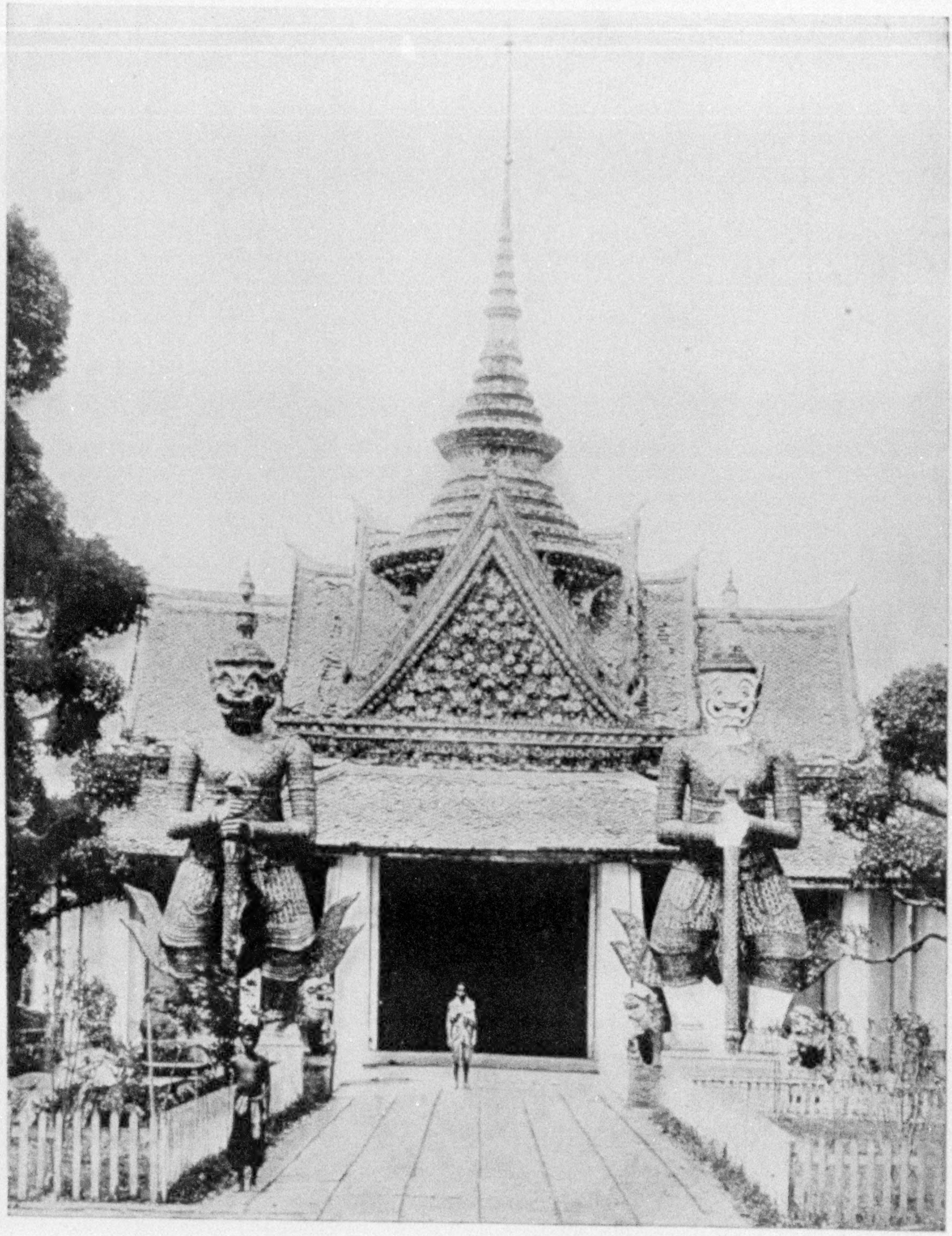

ENTRANCE TO THE KING'S WAT (TEMPLE): BANGKOK, SIAM

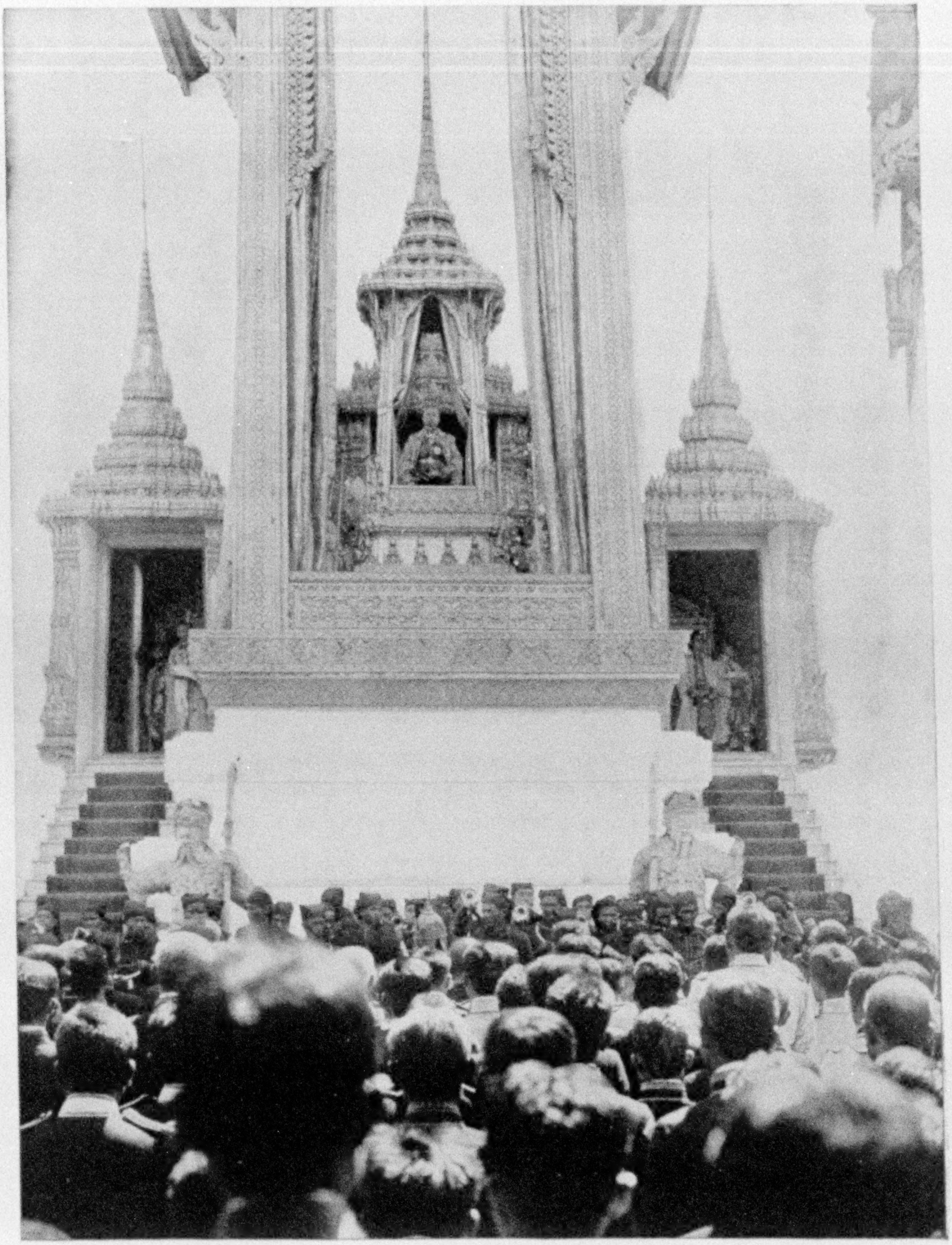

Photo and Copyright by R. Lenz & Co.

ON BALCONY OF THE DUSIT MAHA PRASATH HALL: THE KING RECEIVING HOMAGE FROM MINOR OFFICIALS IN THE COURTYARD

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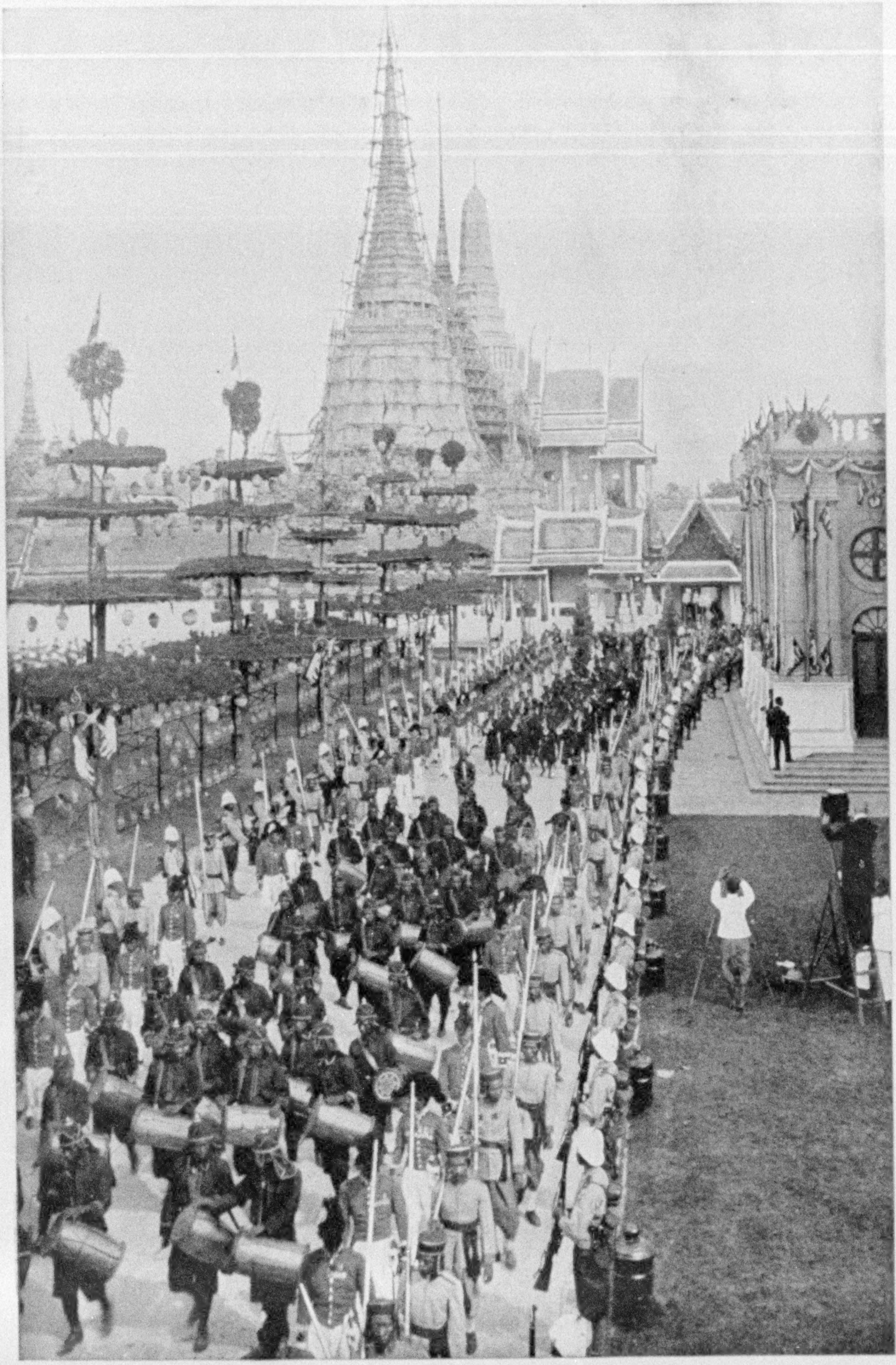

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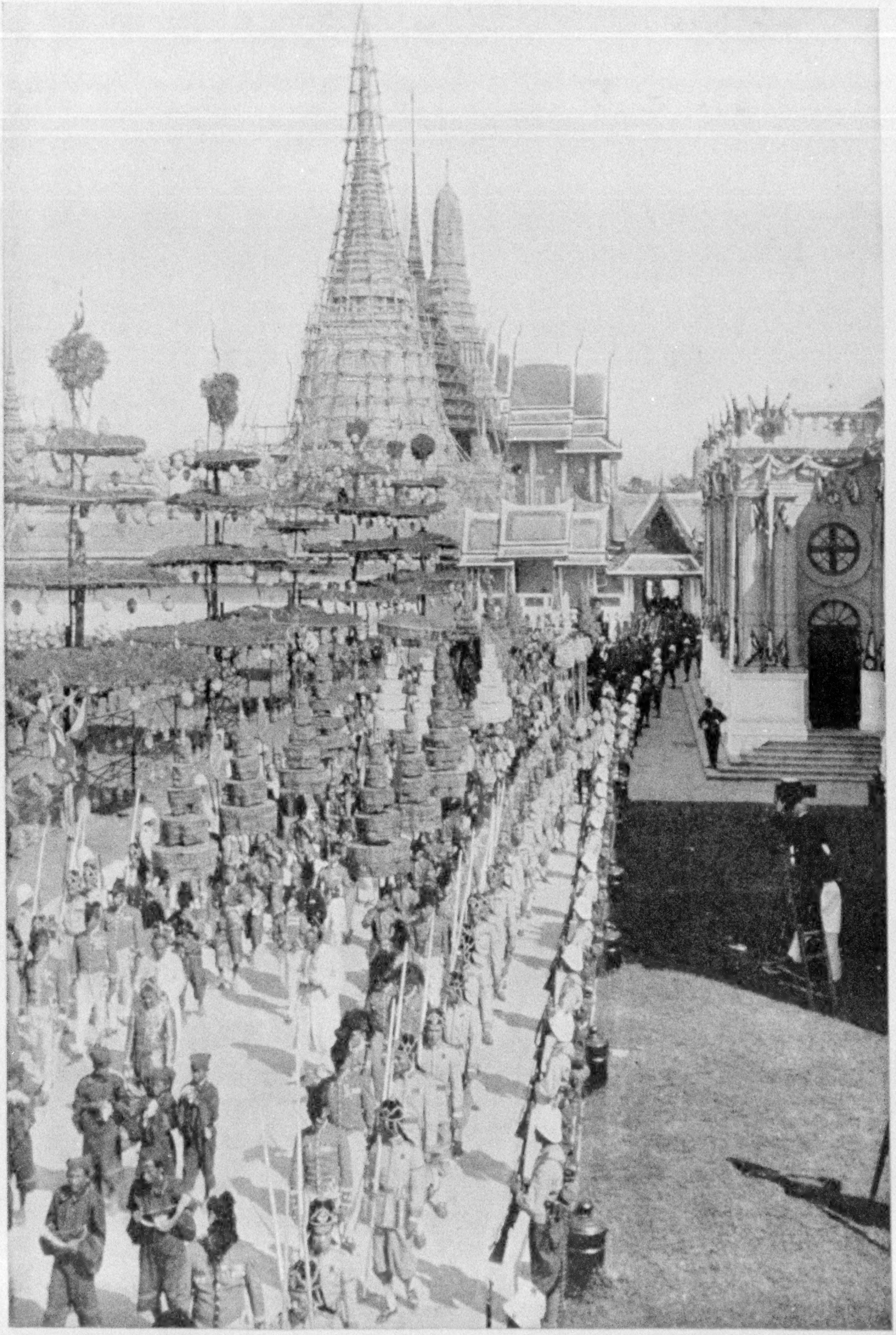
THE GOLDEN DRUMS AT THE HEAD OF PROCESSION CONDUCTING HIS MAJESTY TO THE WAT PHRA KEO AFTER THE CORONATION (SEE PAGE 394)



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THE FIVE AND SEVEN-STORIED ROYAL UMBRELLAS IMMEDIATELY PRECEDING THE KING IN THE PROCESSION TO THE WAT PHRA KEO

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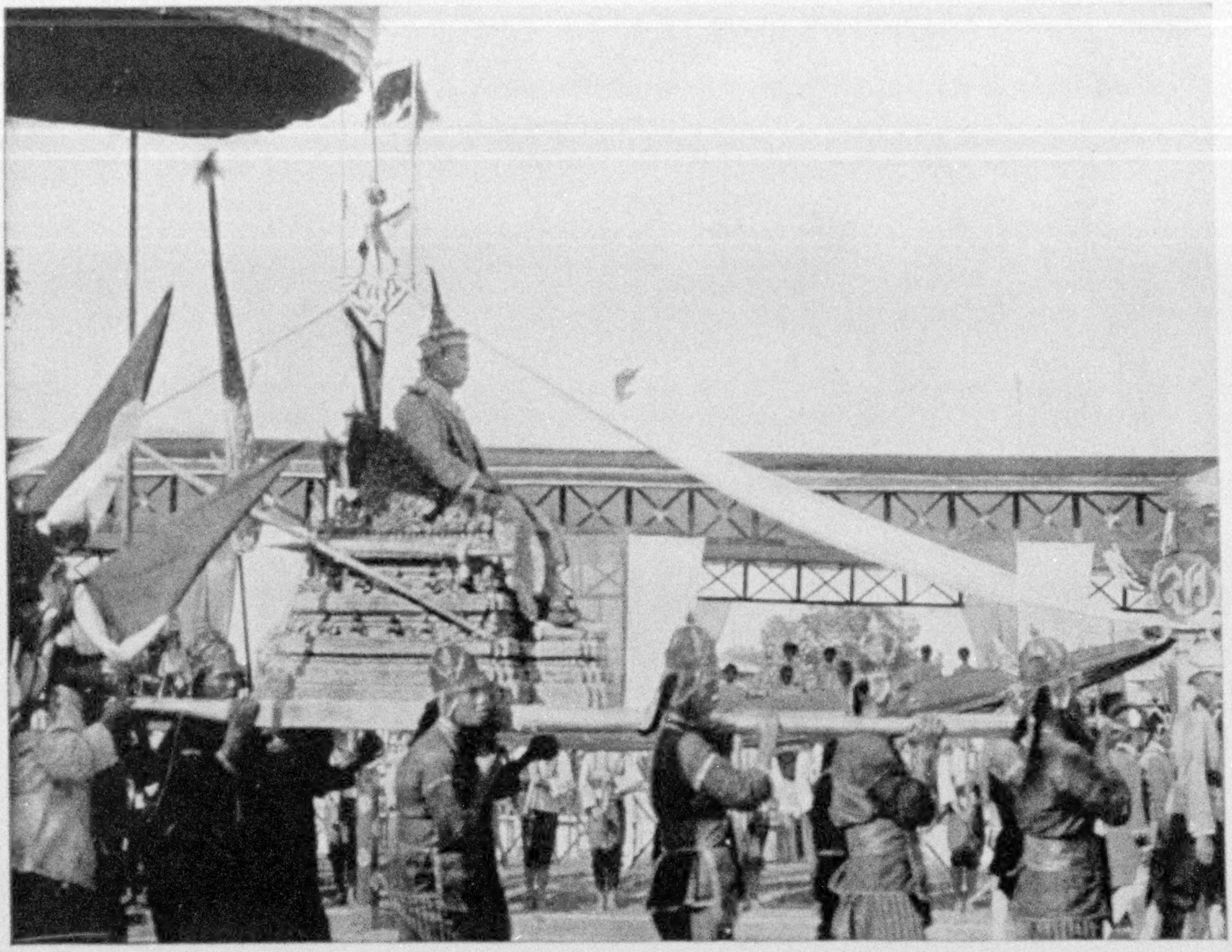


Photo and Copyright by R. Lenz & Co.

THE KING BORNE IN ROYAL PROGRESS THROUGH THE CITY, SEATED ON A GOLDEN PALANQUIN

ments, dressed in dull red, with Tyrian caps. First came the golden drums (see page 392), followed by trumpets of ancient form, then those with conch shells. The noise was not music to foreign ears, but served to give the time. The dull thud of the drums, given every fourth step only, was weird in the extreme.

These were followed by a number of royal five and seven-storied umbrellas (see page 393), in various colors, preceding and following His Majesty, who was borne seated on a golden palanquin surmounted by the usual "prachidee" canopy, with 16 chamelion-looking bearers, who could barely shuffle along on account of the weight of their burden.

On the day after the coronation there was a royal progress through the city in grand state procession, in accordance with ancient custom. In addition to the various royal attendants, a division of about 11,000 troops took part. There were two gorgeous pavilions erected along the route, where His Majesty received addresses from the people and the European community before proceeding to Wat Bavaranives, where the King worshiped before the Phra Jina Siha, the ancient image of Buddha.

On Monday afternoon, December 4, there was another royal progress on the Menam River, in accordance with ancient custom, His Majesty proceeding to Wat Chang with offerings (see pages 402, 403, and 404). This was a most unique and impressive and charming sight. The quaint Oriental costumes—gorgeous red, blue, and cloth-of-gold uniforms of the guards and gentlemen at arms—made a perfect rainbow of color.

The King appeared squatting à la Buddha, on an uncovered golden palanquin, dressed in native costume of cloth-of-gold, wearing a very large broad-brimmed gray felt hat, caught up on one

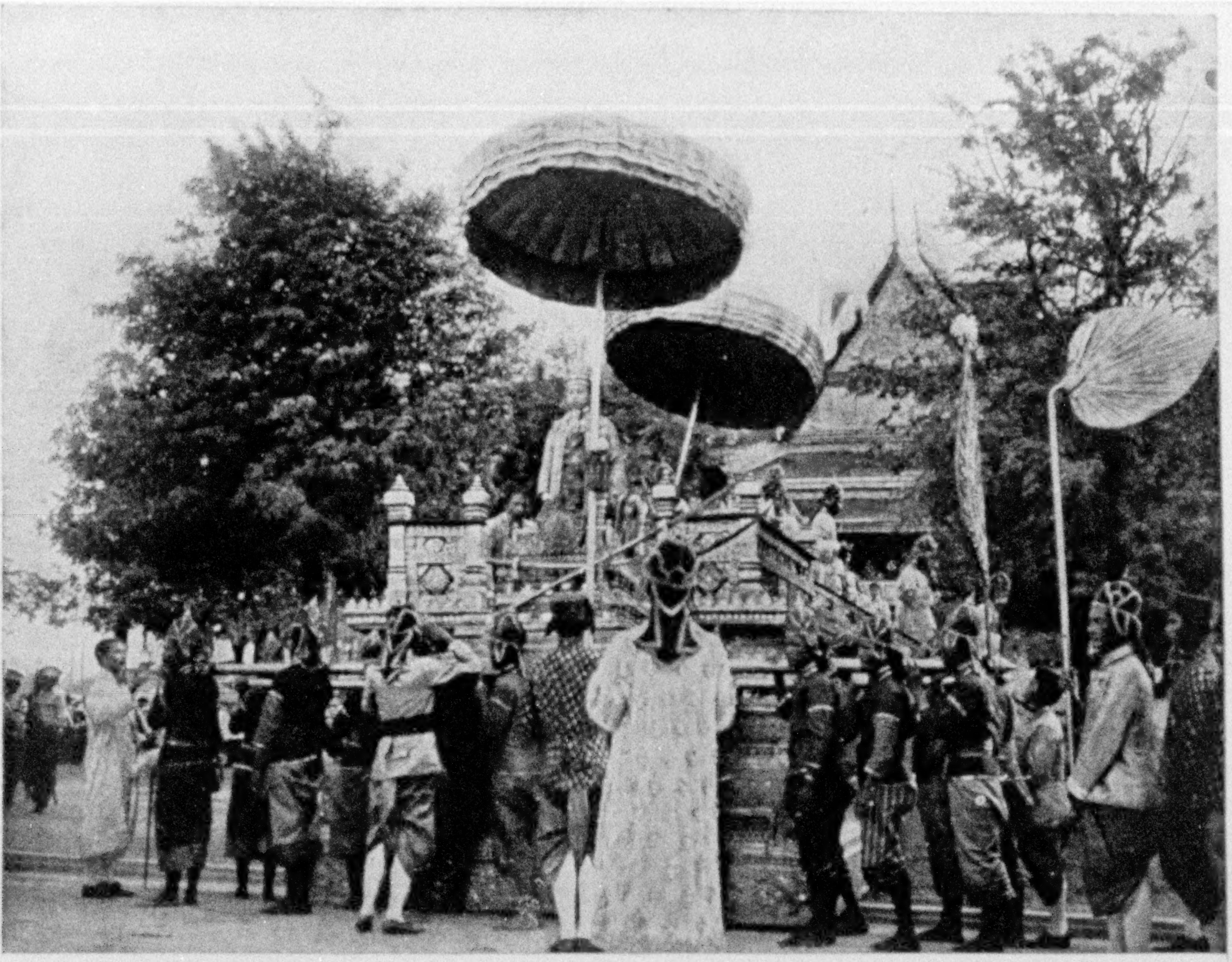


Photo and Copyright by R. Lenz & Co.

HIS MAJESTY LEAVING THE PAVILION OF THE EUROPEAN COMMUNITY

side with a superb aigrette, and surmounted by a miniature copy of the "prachidee" crown (see page 399).

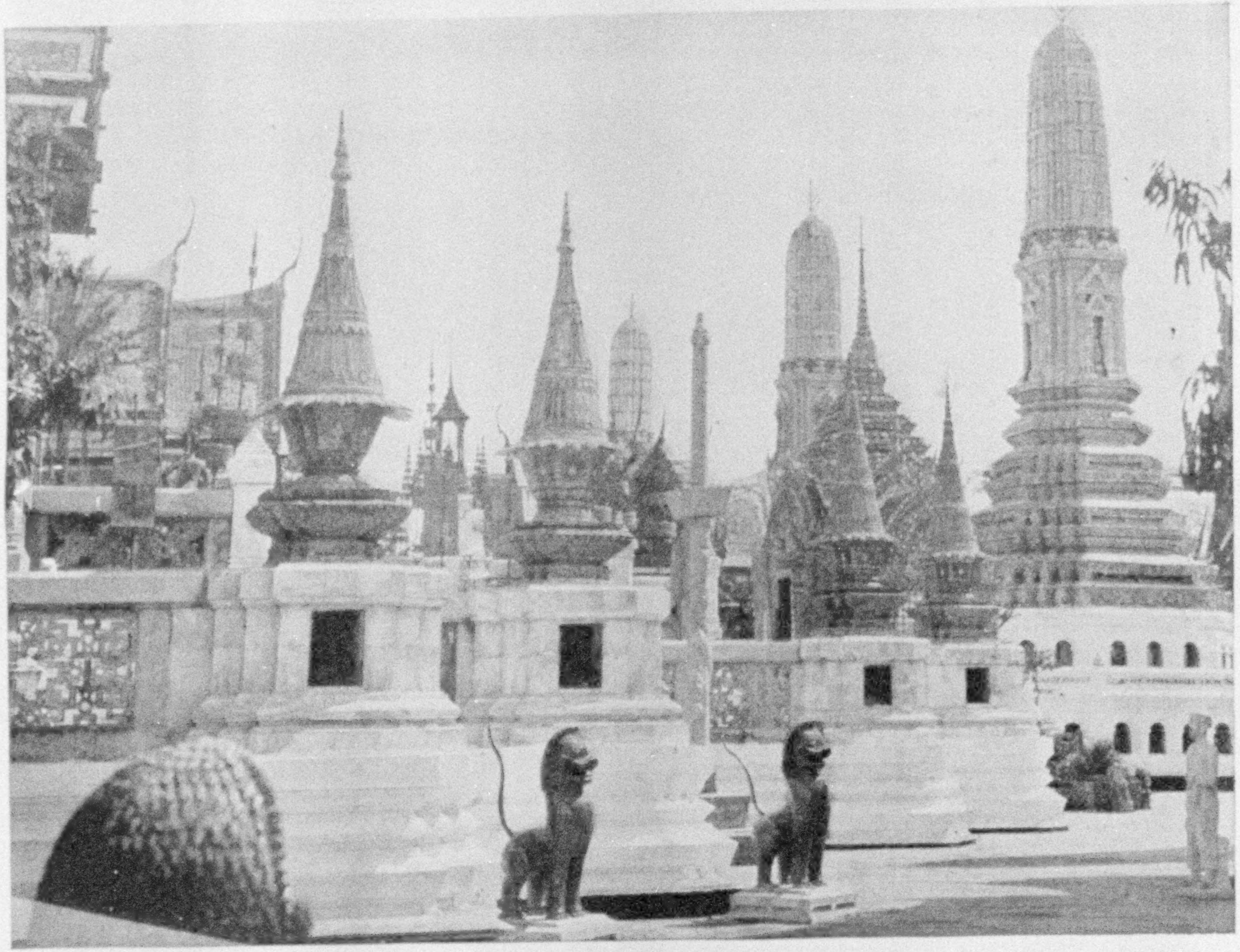
A double column of state barges, black lacquered, some with golden patterns, and propelled by paddles, manned by the navy in ordinary sailor's uniform, were a full hour in passing, all stopping to salute the King. Fifty paddlers were in each barge, with an officer and his guard under a red canopy amidships.

The King's own royal barge (see page 401) was of solid gold lacquer with filagree effect; the prow was the head and neck of a most remarkable-looking beast, a combination of a snake and a griffin, though it was called the "golden swan." There were 60 paddlers, in solid red, with queer close-fitting caps, with a cape behind and in front of the ears. As the King entered and left the barge, they in unison placed their hands in the position of Buddhist prayer and bowed over until they were doubled up and moaned. This they repeated three times.

The paddles were covered with gold leaf, and after each stroke they threw them up in the air, where the brilliant sun on the silver of the dripping water made a most beautiful effect. They all chanted at the same time.

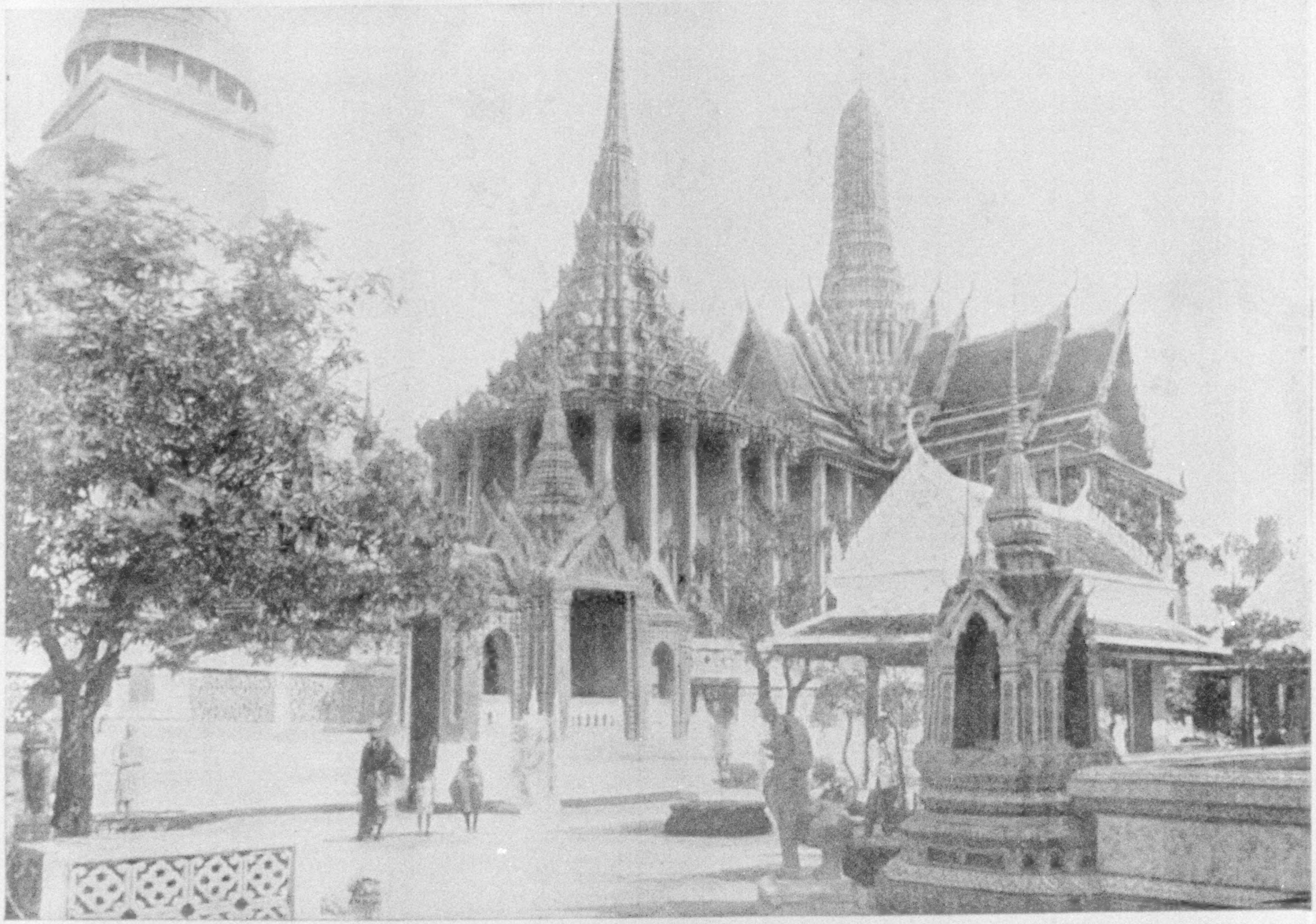
Two similar barges, with large drooping white plumes instead of the swan's head, bore gifts to the wat they were en route for, under a scarlet canopy in the middle of the barge. It was very dignified and impressive. All the ships in the river were dressed, and the usual booming of salutes and music by various bands on the men-of-war in port were heard.

The afternoon of Tuesday, the 5th, the King received an address from the students of all the schools in a temporary pavilion at Thong Sanam Suang. This pavilion was a beautiful structure, with



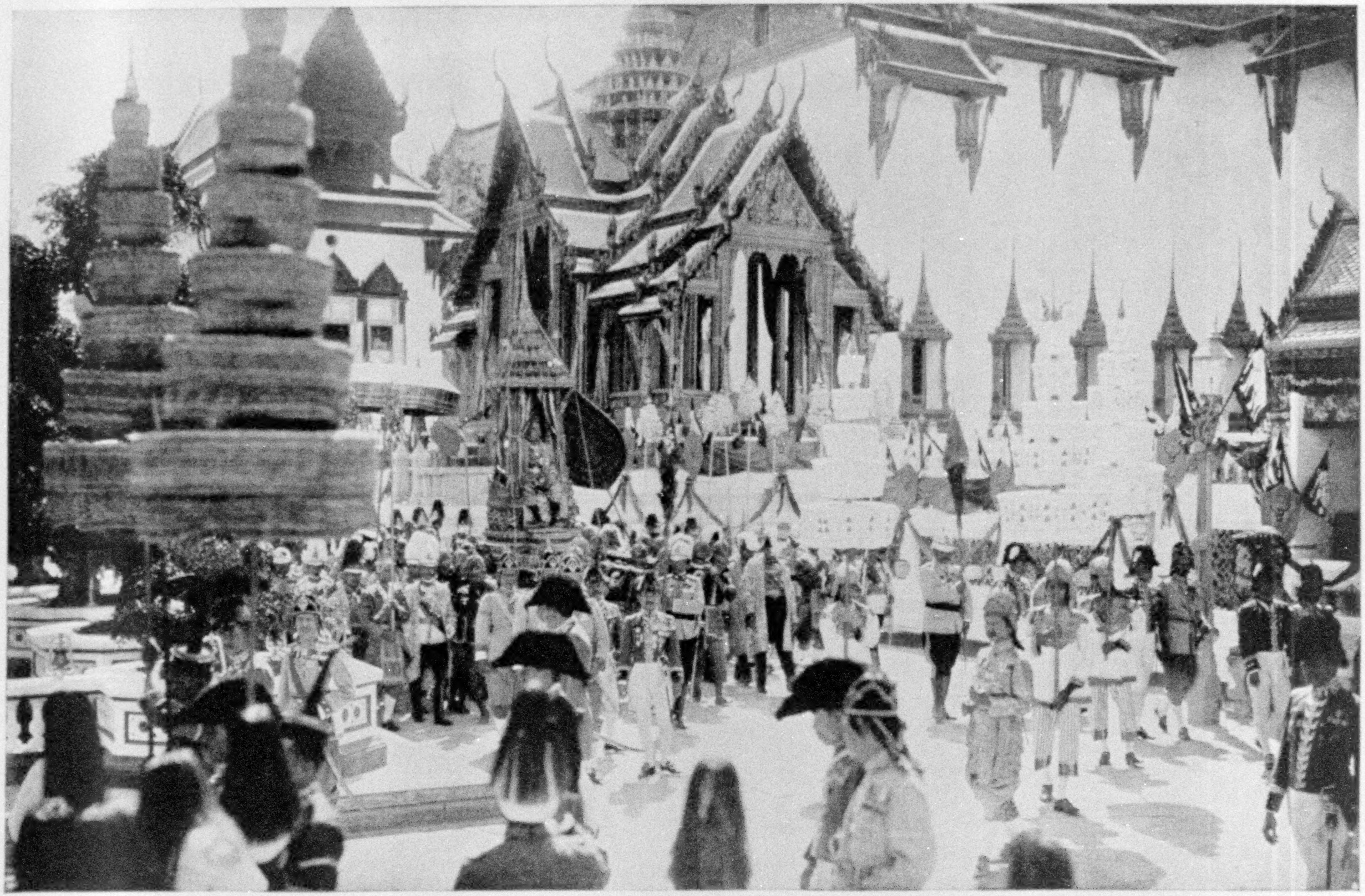
THE WAT PHRA KEO, WHERE THE KING DECLARED HIMSELF THE DEFENDER OF THE FAITH (SEE PAGE 389)

XUM



THE KING'S TEMPLE, WAT PHRA KEO

All woodwork inside and out of this temple is covered with gold leaf, and the walls are a glittering mass of colored bits of glass set in the stucco in designs



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HIS MAJESTY THE KING IN THE PROCESSION: NOTE THE SEVEN-STORIED ROYAL UMBRELLAS ON THE LEFT AND THE WHITE FIVE-STORIED UMBRELLAS ON THE RIGHT

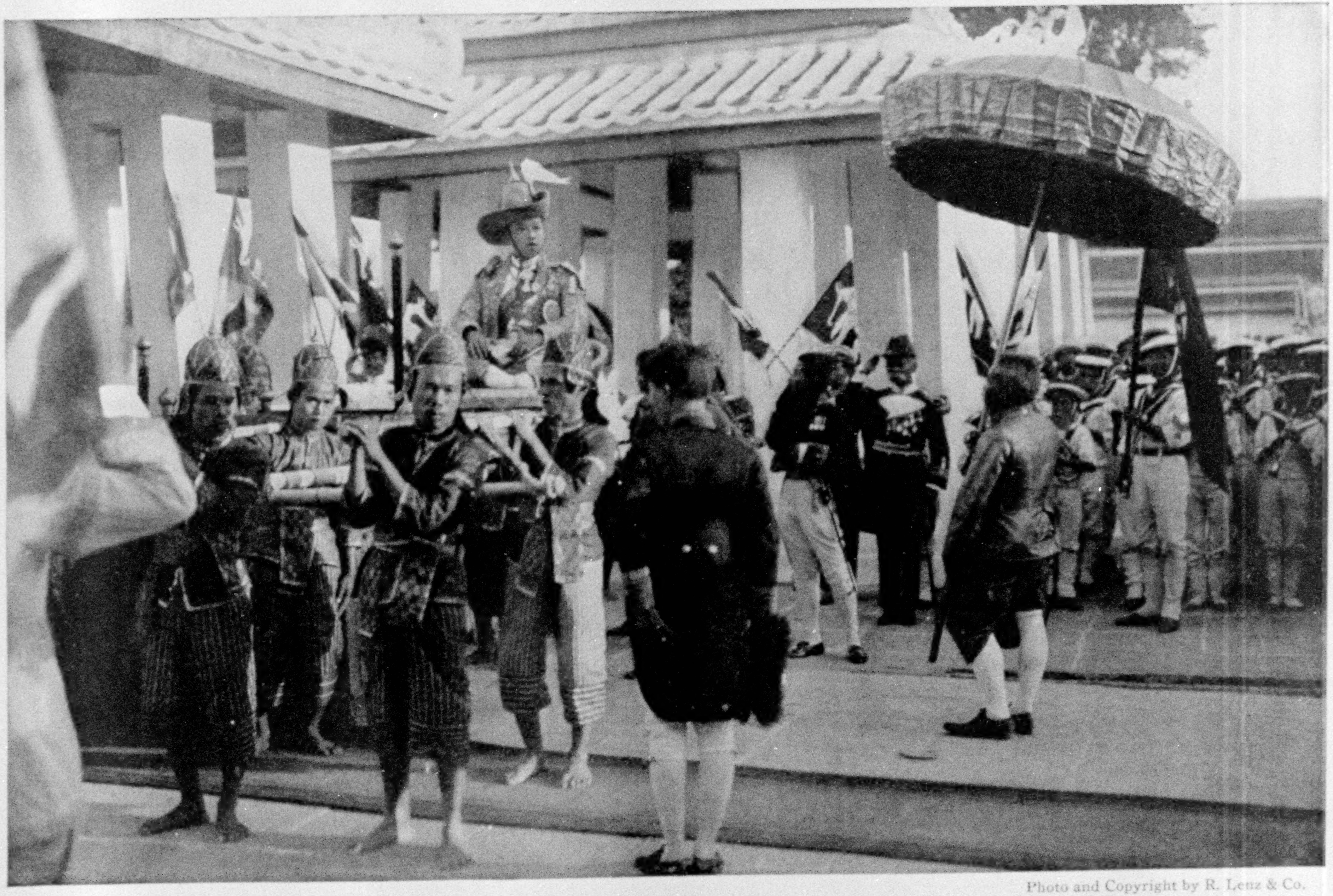


Photo and Copyright by R. Lenz & Co.

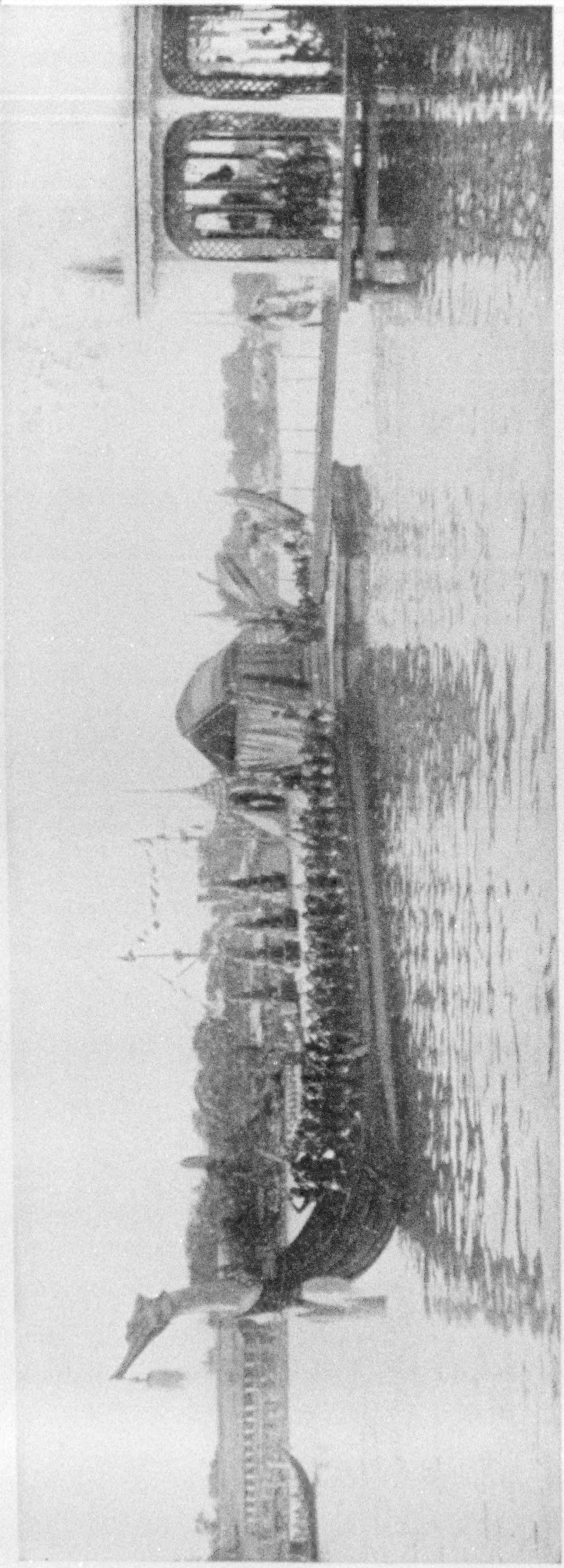
THE KING ARRIVING AT THE PAVILION ON THE RIVER FRONT FOR THE WATER PROCESSION (SEE PAGE 393) red and cloth-of-gold hangings, the exposed woodwork following the same color scheme.

There were thousands of children, both boys and girls, grouped by schools. After the address the boys marched past in review. Most of them belong to Boy Scout organizations and wore the appropriate uniform, as much is being made of this movement in Siam.

That evening there was held a gala performance at the Theater Royal by the Royal Company of Masked Players in honor of the coronation fête, which only invited guests of His Majesty attended. It began at 10 p. m. and ended at 3 a. m., with an hour's intermission at midnight for an elaborate buffet supper.

I have never seen a more fairyland-like interior or a prettier house, the various-colored costumes of the ladies and brilliant uniforms of the men all spread out before one. The stage was lower than with us and extended way out into the audience, so that the parquet was on both sides as well as in front. The ceiling was composed of heavy white clouds of cotton, with openings for the electric lights to shine through.

Two plays were given, or rather acts from them. The action was entirely a ballet performance of Siamese dancing or posturing and slow, deliberate movements. The actors or dancers never spoke, but the tale was told by a sort of chanting Greek chorus behind the scenes. Both plays were allegorical, one an incident from their mythology and the other of the wars between the monkey people and the demons.



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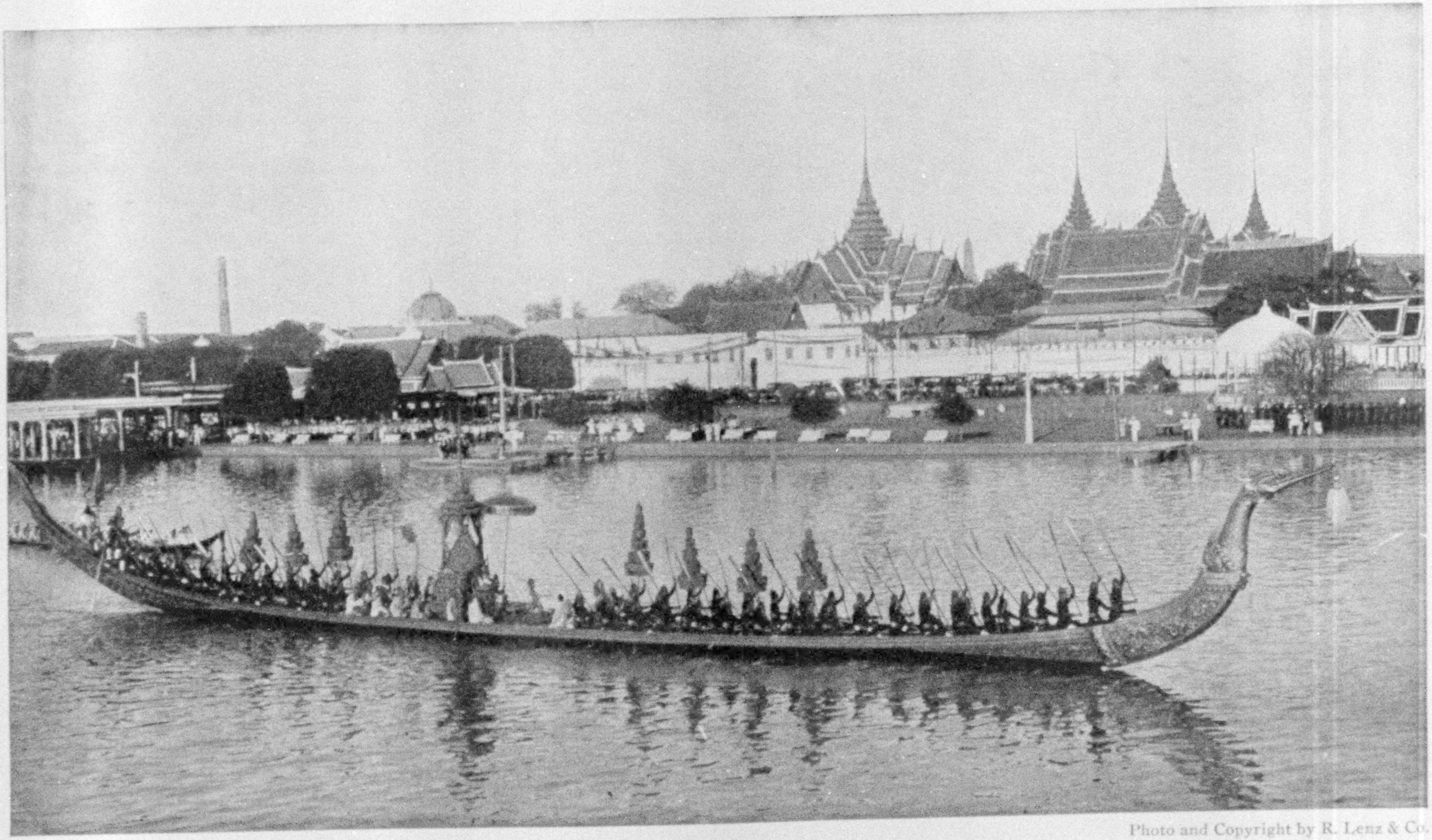
HIS MAJESTY EMBARKING ON THE ROYAL BARGE



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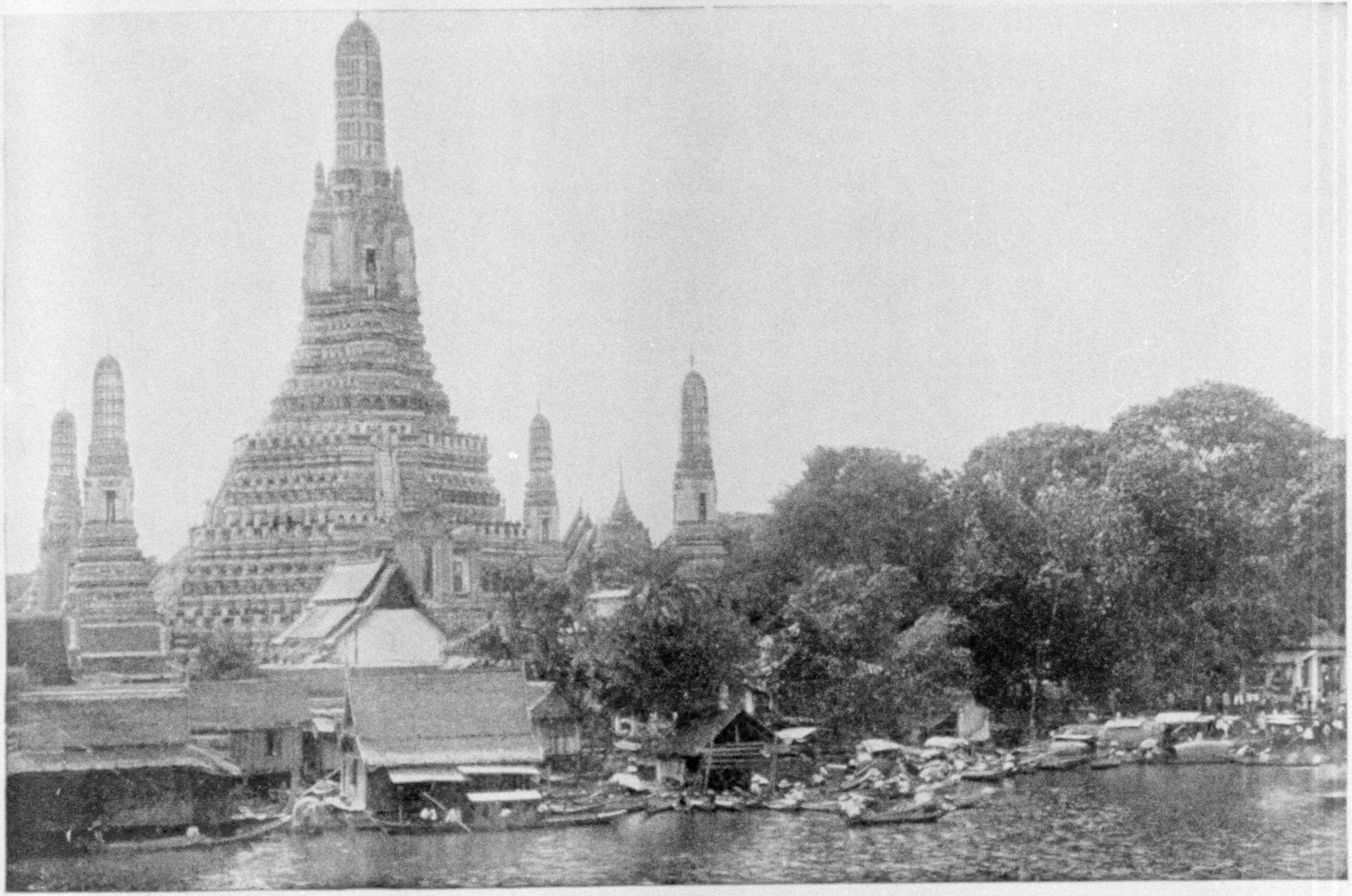
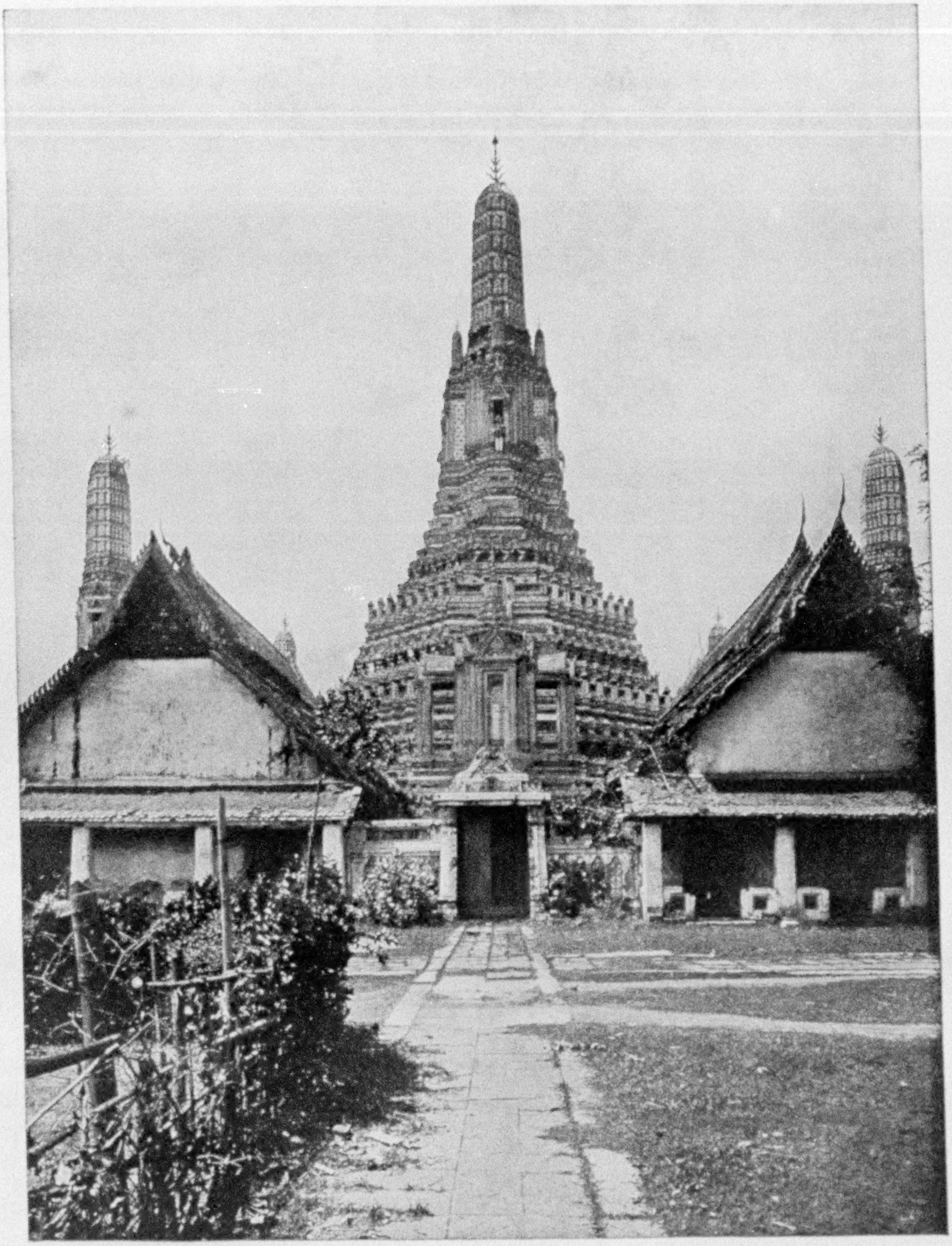
THE ROYAL BARGE OF SOLID GOLD LACQUER AND MANNED BY 60 PADDLES COVERED WITH GOLD LEAF: THE KING EN ROUTE TO WAT CHANG IN THE WATER PROCESSION (SEE PAGE 395)



THE GREAT TEMPLE OF WAT CHANG



COURT IN THE GREAT TEMPLE OF WAT CHANG

The Siamese claim that Buddhism is found in its purest form in Siam. It is the Buddhism of the southern school, which extended through Ceylon, Burmah, Siam, and Indo-China, and is comparatively free from those corruptions of the faith which are found in the Buddhism of the northern school, or Llamaism, as it might better be called. It must be acknowledged, however, that a great deal of Brahmanism has crept in through past ages, bringing in its train the superstitions which especially show themselves in the employment of astrologers to determine upon auspicious times for important events, and the part played by Brahman priests in all semi-religious festivals.

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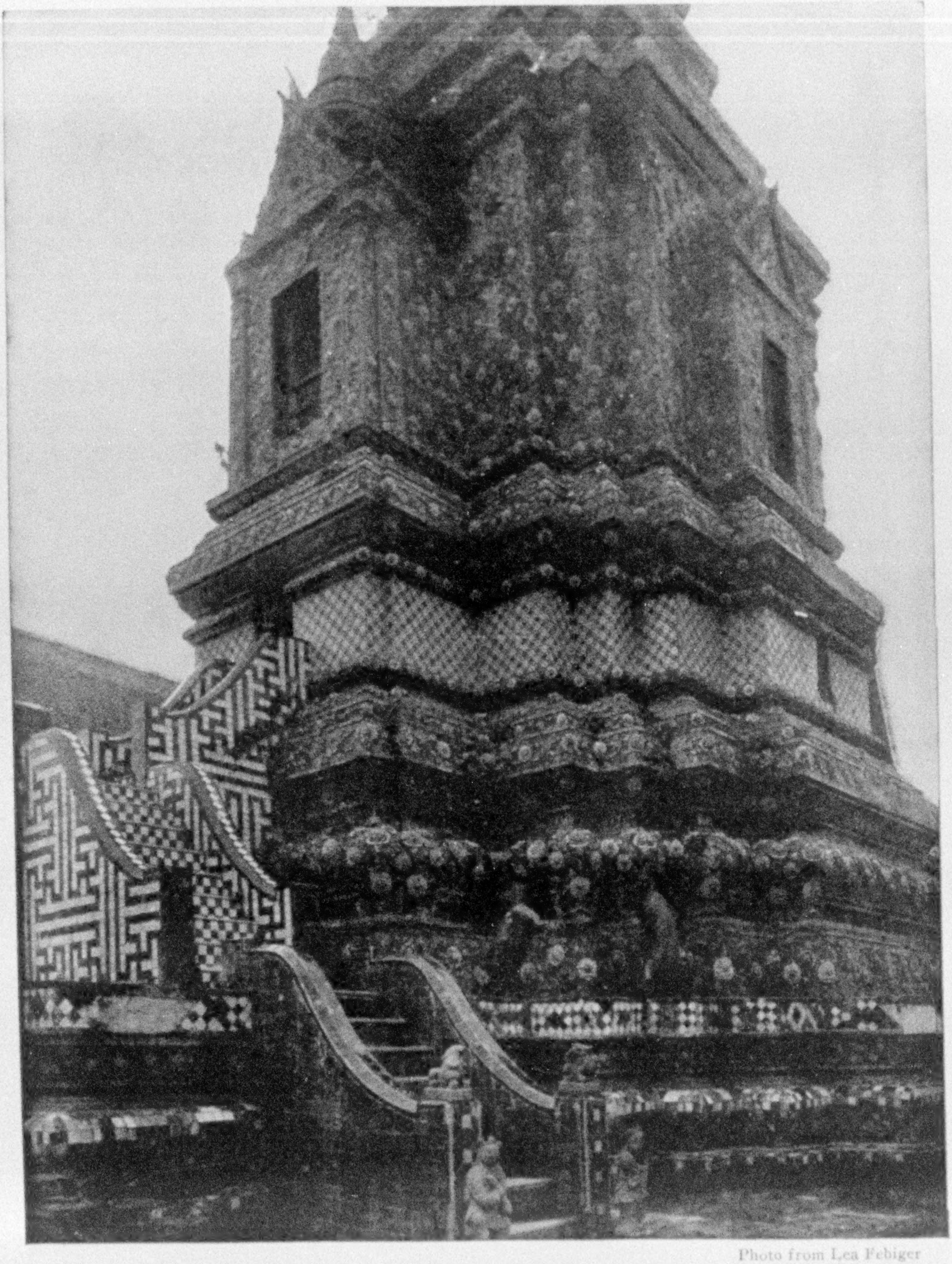
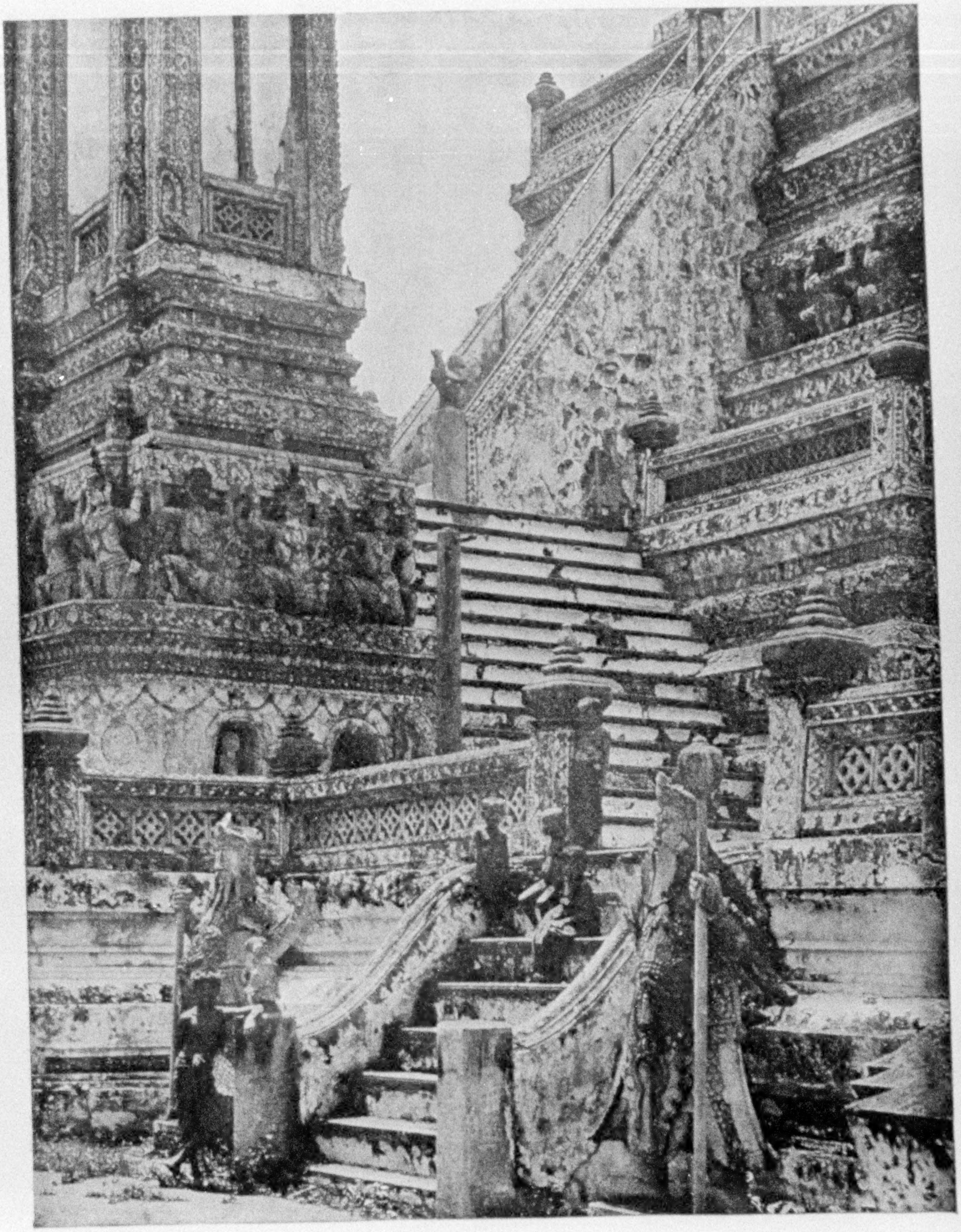


Photo from Lea Febiger

A DETAIL OF THE TEMPLE OF WAT CHANG



A STAIRCASE OF THE TEMPLE: WAT CHANG

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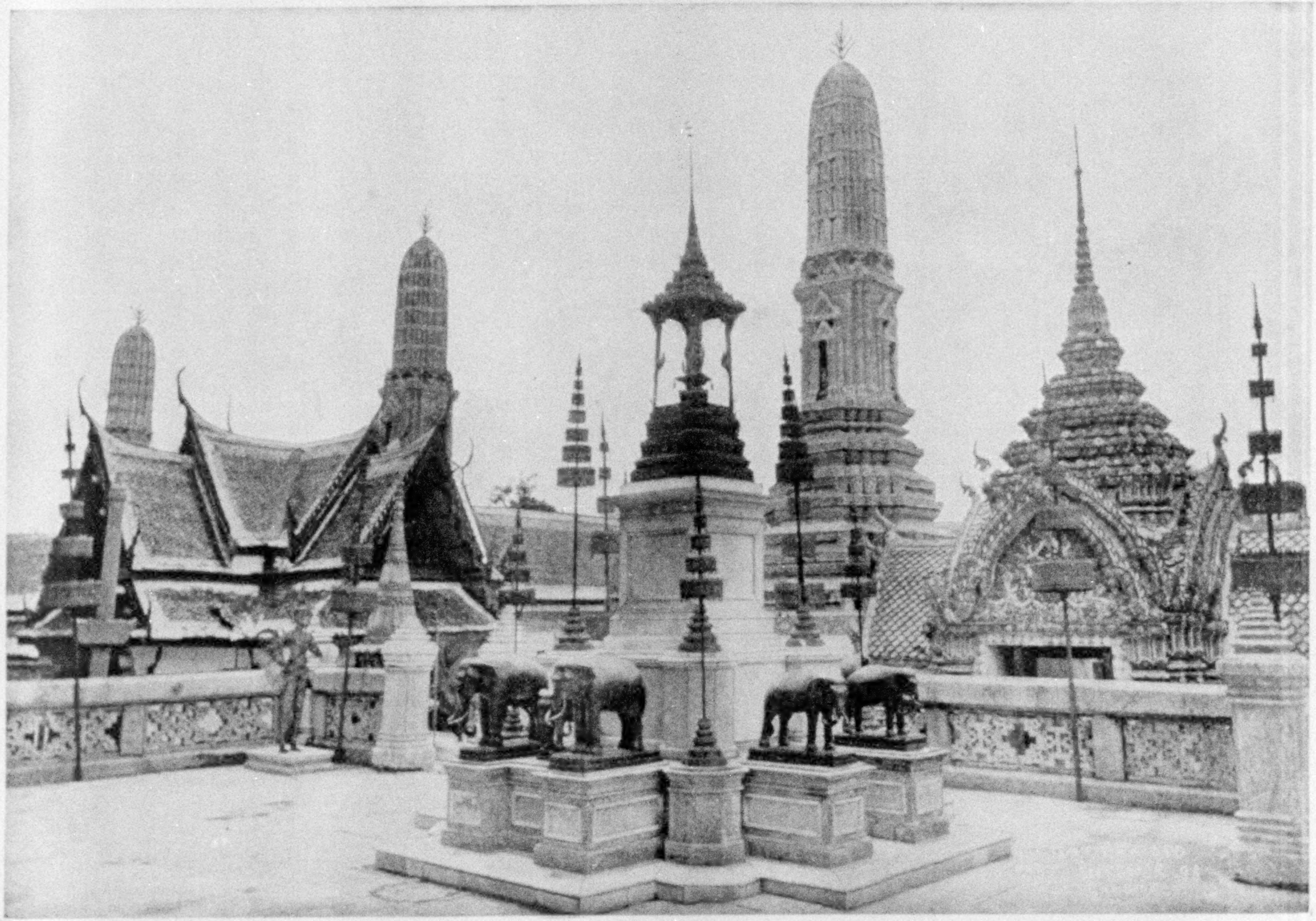
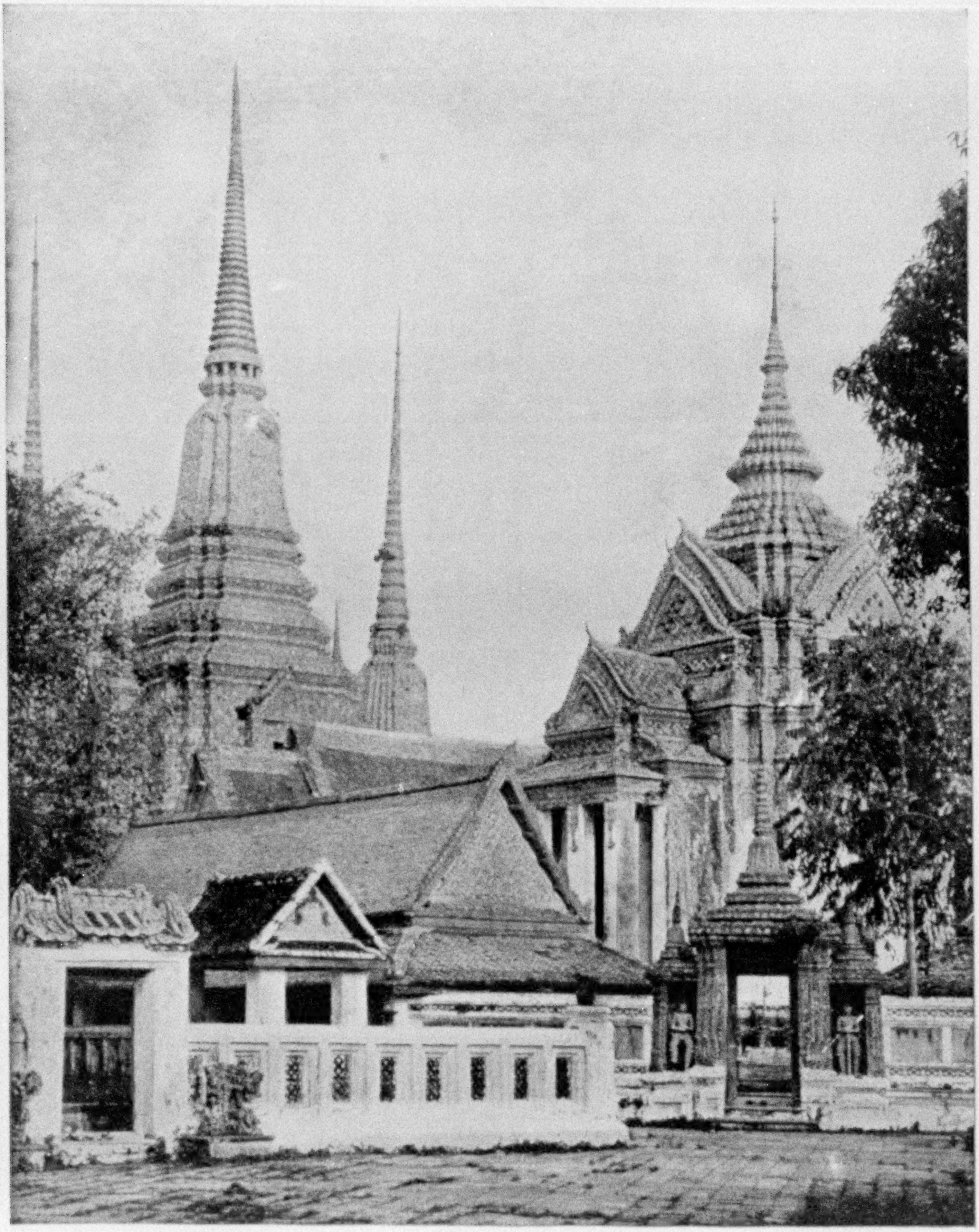


SCENE WITHIN THE GROUNDS OF THE WAT PHRA KEO, THE MOST BEAUTIFUL TEMPLE IN BANGKOK (SEE PAGES 396 AND 397): NOTE THE ROYAL SEVEN-STORIED UMBRELLAS



ANOTHER SCENE IN THE WAT PHRA KEO: BANGKOK

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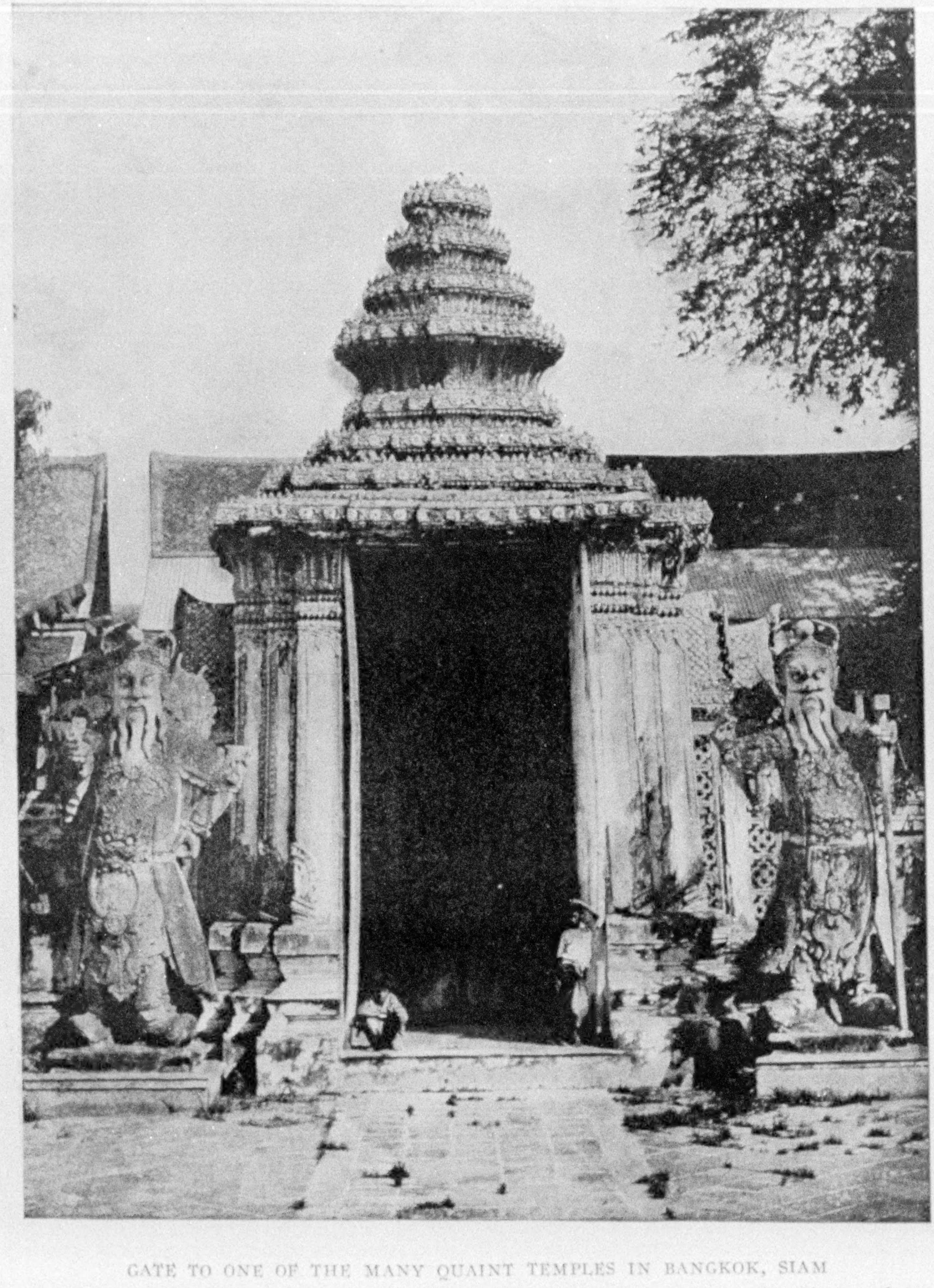
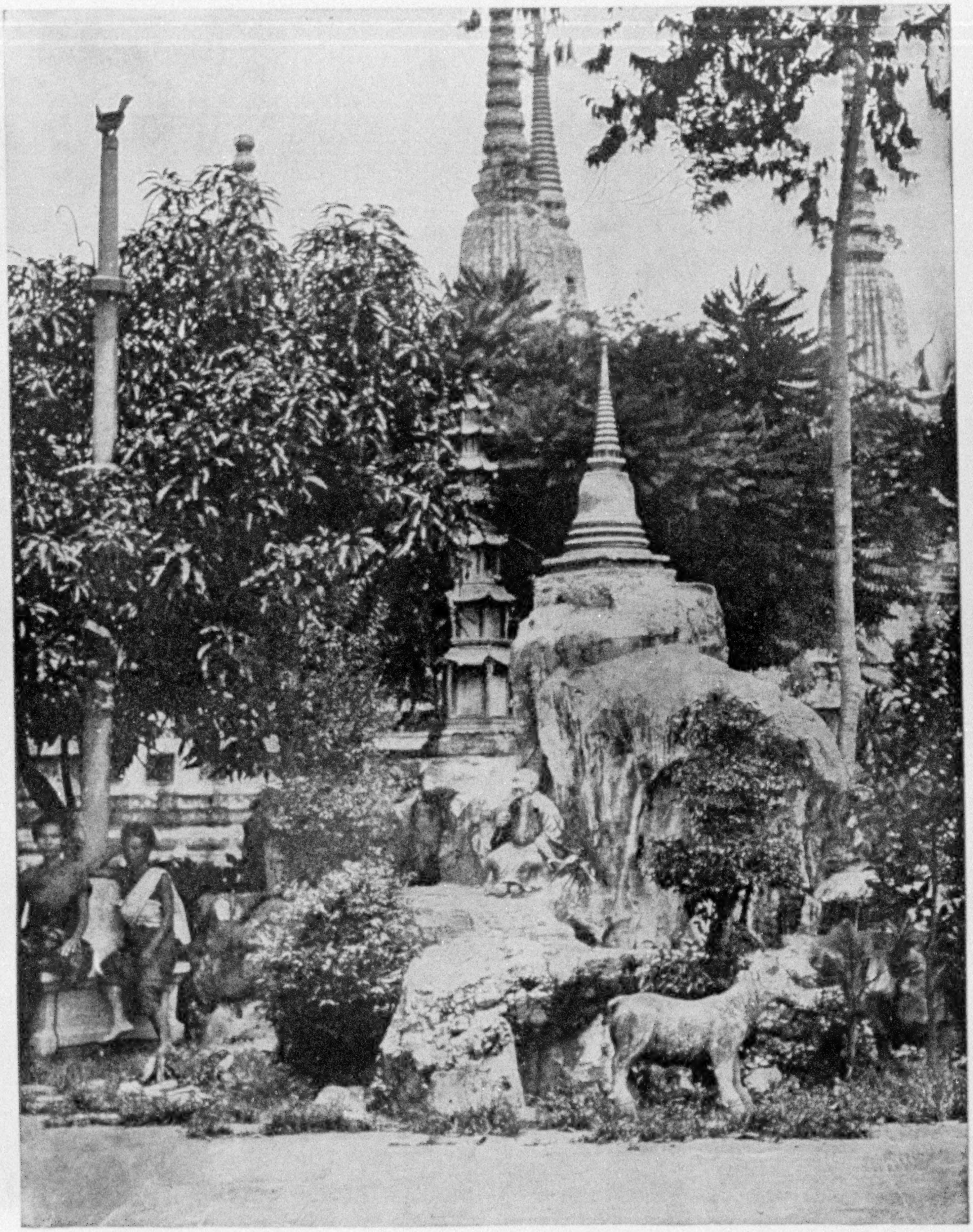


GATE TO ONE OF THE MANY QUAINT TEMPLES IN BANGKOK, SIAM

Siam has in the priesthood about 88,000 priests, 38,000 novices, and 71,000 boys in attendance, or a total of 197,000 devoted to religious work in a population of 6,750,000. The Siamese government is very progressive and is utilizing this great band of religious workers, which might otherwise be injurious, to educate the people in modern lines. Schools are being established in the temples with priests as teachers of elementary modern education, and normal schools are also being founded to prepare the priests for this work.



SCENE IN THE ROYAL PALACE GROUNDS: BANGKOK

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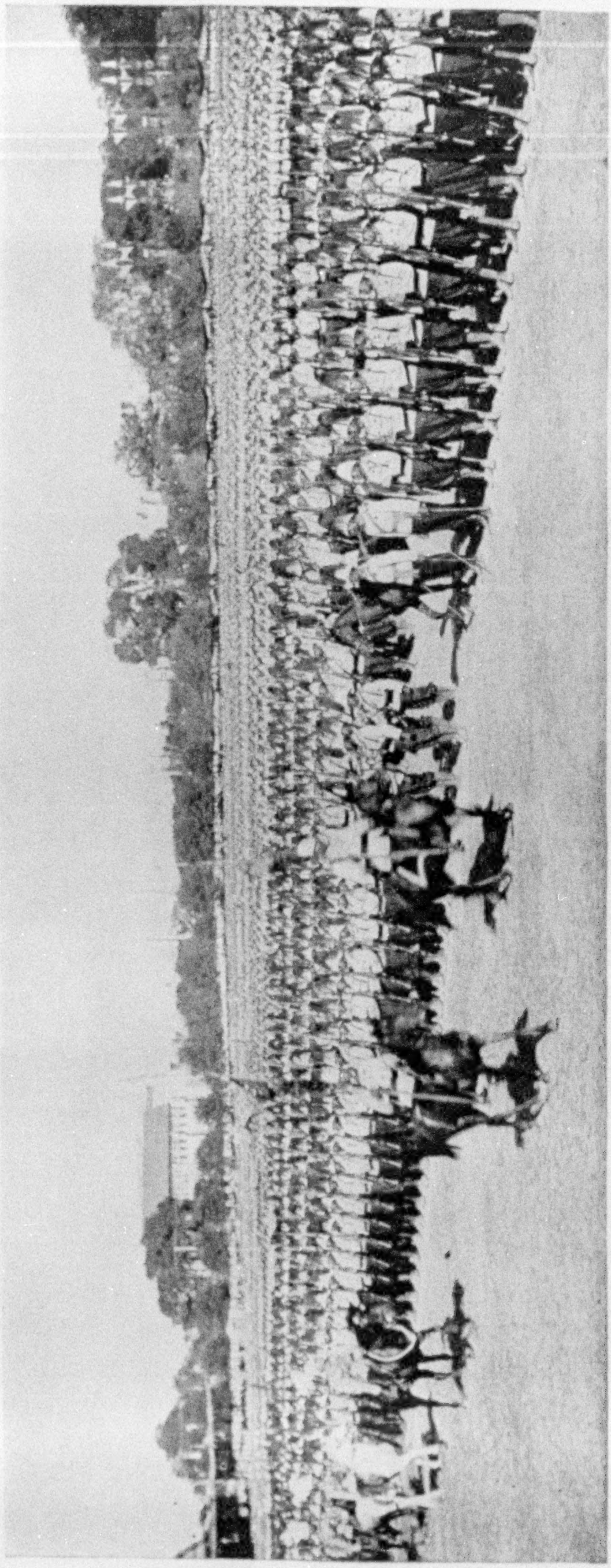

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REVIEW OF 26,000 SIAMESE TROOPS OF ALL ARMS: THE KING RIDING AROUND THE LINES

On Wednesday, the 6th, the ceremony of the presentation of new colors by the King to the various regiments of the army was held in the pavilion at Thong Sanam Luang. Each regiment was represented by a company. There was first a long chanting by the priests in blessing the flags, and then each colonel, supported by his color-bearer, moved forward and formed on three sides of a square directly in front of the King.

The colonels advanced one at a time, saluted, dropped on one knee, and received their colors from the King's hands, and then returned to their places. When all had been thus delivered, at a signal the colonels turned and gave the colors to the color-sergeants in their rear. All rejoined their organizations and marched past in review, with the colors on the review flank of each supporting company.

On Thursday was held the grand review in the Thong Sanam Luang field. It is not a very large space, yet 26,000 troops of all branches were massed in it in closed formation.

After the King had ridden around the lines, they were faced to the rear and, impossible as it seemed, still more densely massed to give space in front for the march past. This was very well done indeed, with beautiful alignments. They had a sort of modified "goose step" when passing the reviewing point, evidently

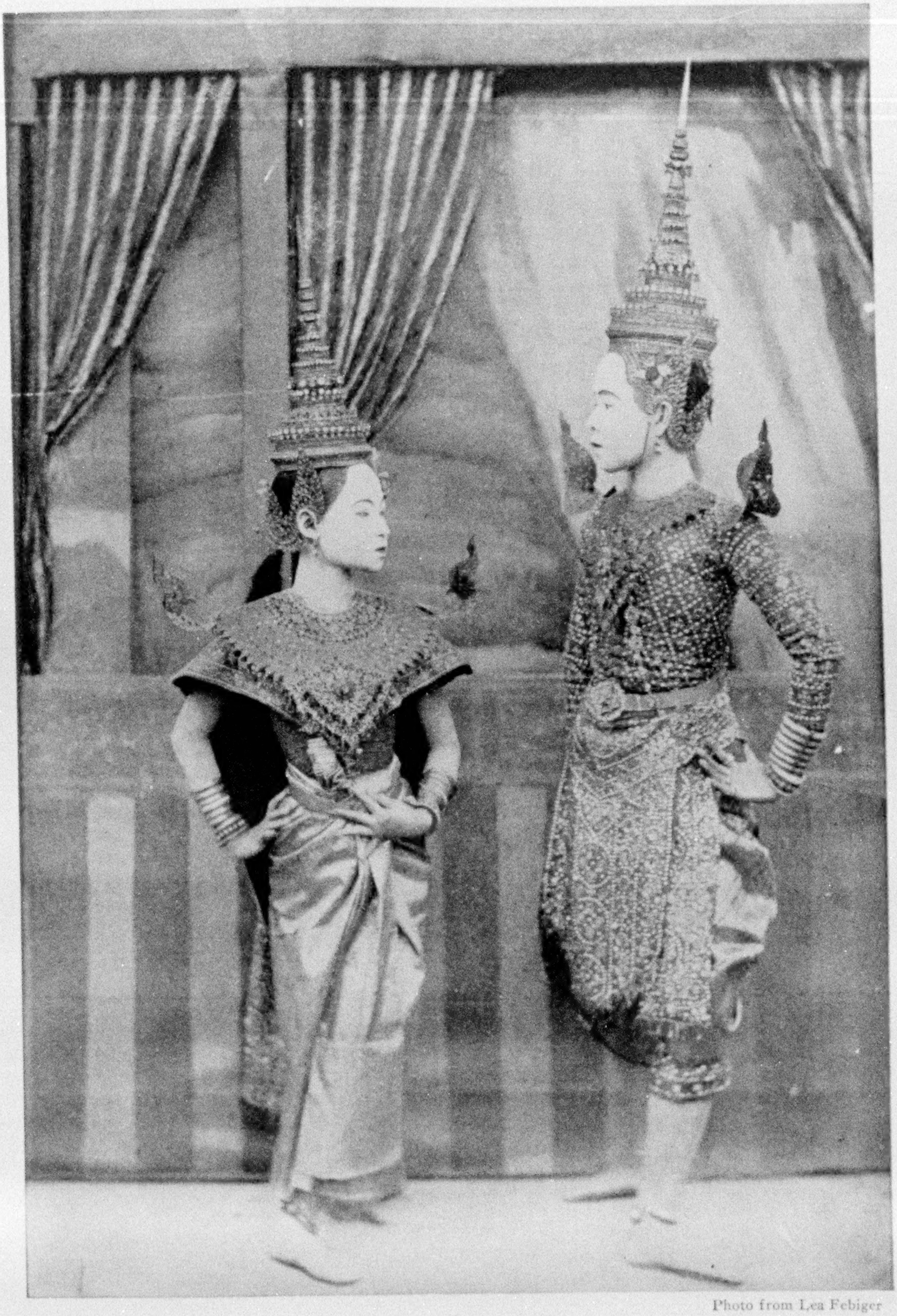

Photo from Lea Febiger

A PAIR OF ROYAL MASKED PLAYERS

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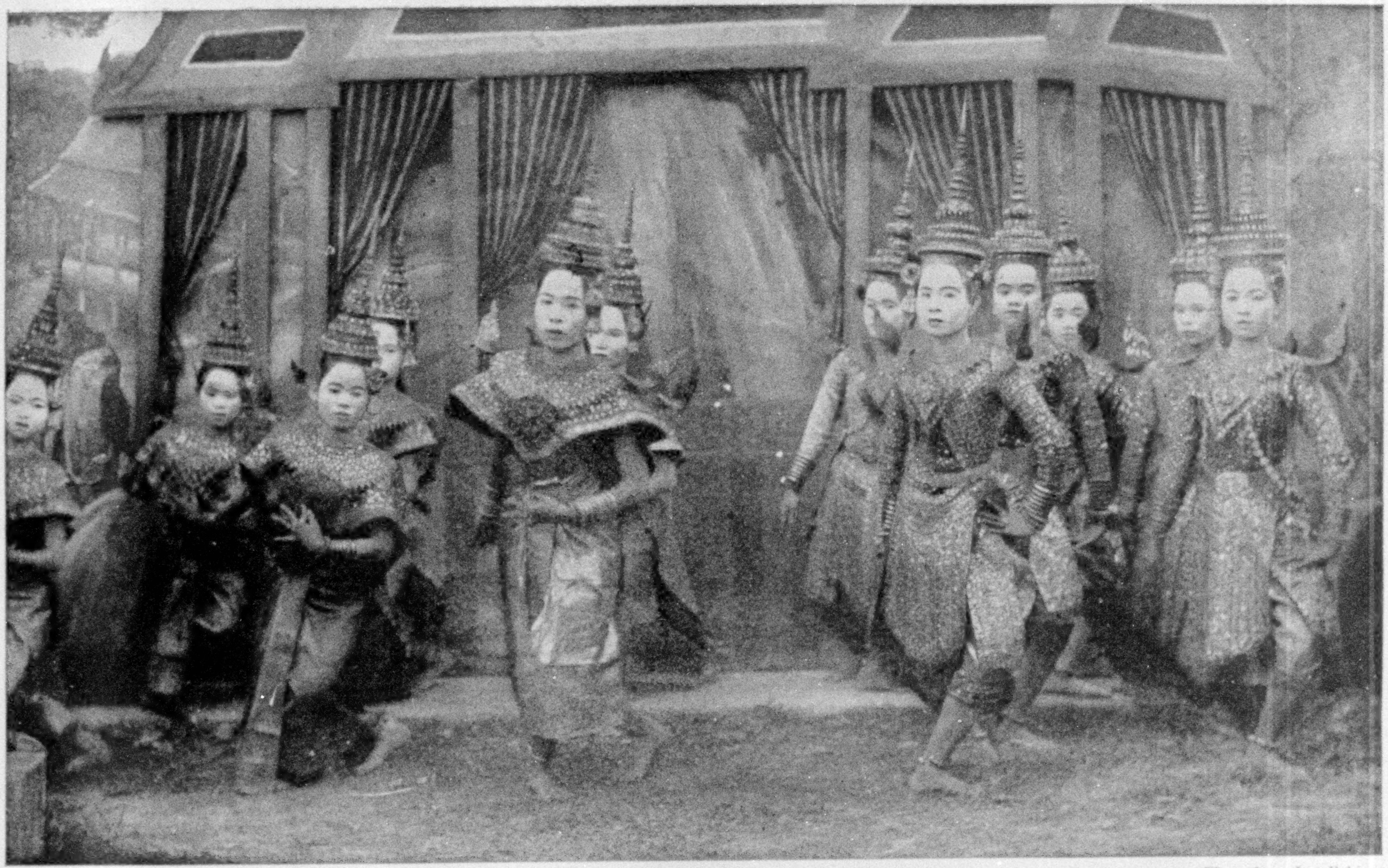


Photo from Lea Febiger

GROUP OF ROYAL MASKED PLAYERS

taken from the Germans, and an exaggerated swinging of the disengaged arm to accentuate the time; they also took a very long step and marched very fast. It could not be kept up for any length of time.

After the march past, all the senior officers assembled, mounted, in front of the King, when the Minister for War (a prince of the blood) was promoted to the rank of field marshal and presented with a gold baton. The King's younger brother and heir apparent was at the same time made a full general of the army. Three hours were taken up by the ceremony.

That evening a reception was given by the head of the Ministry for War at the War Department building. About 4,000 troops marched past in a torchlight procession, and then filed into the inner court, where they performed various evolutions, making complicated figures of light, ending with an enormous outline of the royal crown.

In the early morning of Friday, the 8th, there was an excursion by rail in the King's luxurious private train, for such official visitors as desired to see the ancient capital at Ayuthea, some forty miles up the Menam River, and to Bang-Pa-In, the royal country palace. The appointments of the train and royal launches that met us were of the usual lavish and luxurious type, with every detail of hospitality.

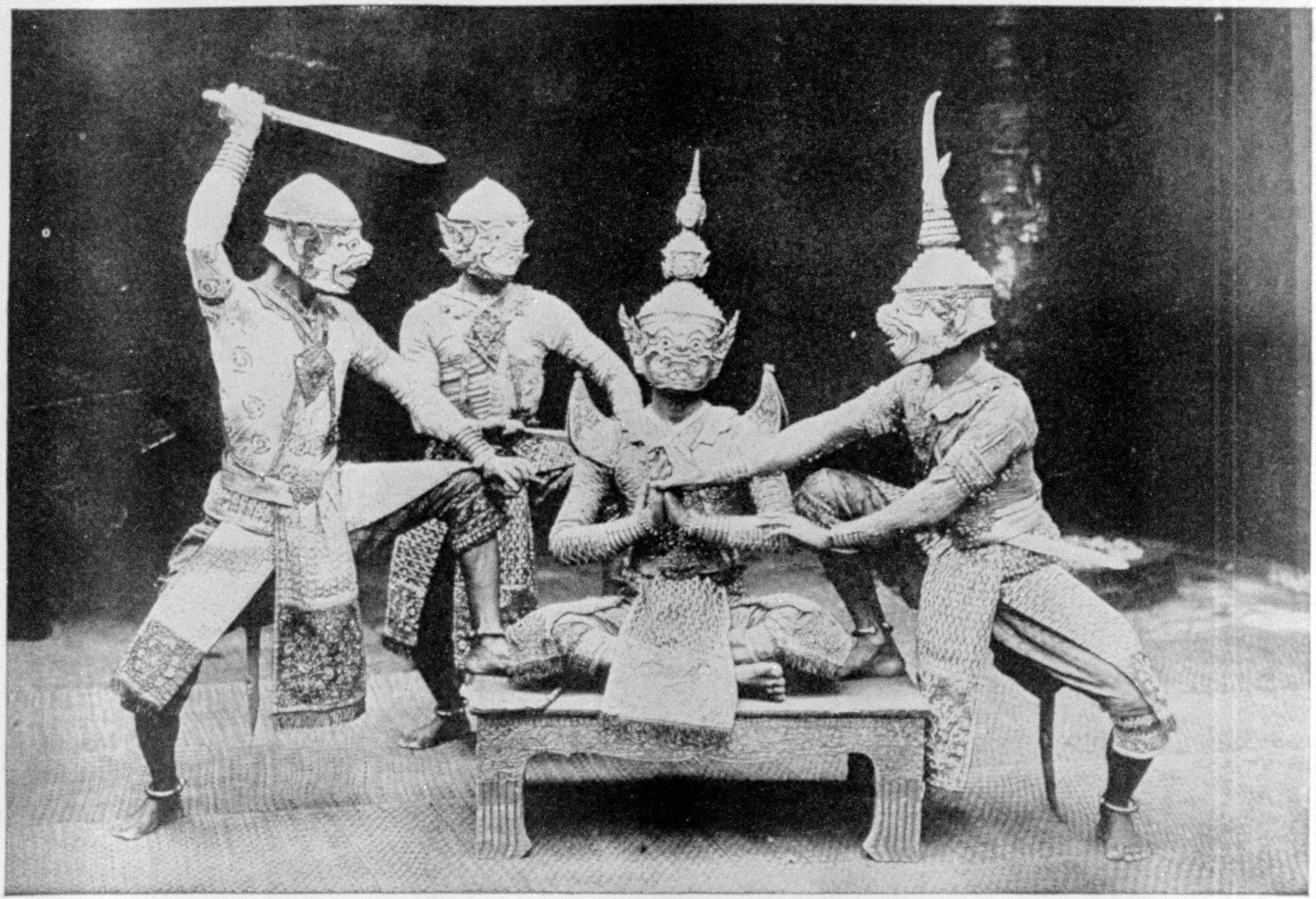
In the evening a reception and exhibition of fireworks were given by the Ministry of Marine at the royal landing, near the palace, on the river. All the ships on the stream were decorated with electric lights. The daylight water parade was practically repeated, with the royal barges outlined in electric lights of various colors. The crews chanted a lauditory welcome to their ruler as they passed. The exhibition closed by there suddenly appearing from out the gloom, a mile or more down river, a beautiful white temple (Wat Chang), illuminated by colored Bengal fires.

On Saturday, the 9th, a grand muster by the Honorable Corps of the Wild Tigers was given on their club-house grounds. This corps is a sort of grown-up Boy Scout aggregation, and was instituted by the present King. They wear a similar uniform to the Boy Scouts. It is composed of office-holders and others who are not subject to conscription for the army, and is a purely volunteer association, with the King as its head. Wild Tigers was the native name for the ancient militia of the land, revived for this organization. There were fully 5,000 on the field, and as they would mass up at a run suggested, in their black uniforms with yellow trimmings, the swarming of a lot of bumble bees. A mounted detachment of them acted as special escort to the King, and were very effective, with tiger-skin saddle cloths and long lances with drooping white plumes midway of the shaft.

Next evening there was a reception at their club-house. The extensive grounds were beautifully decorated, a veritable dream of fairy-land. Each company—and there must have been at least fifty—had a booth where they dispensed drinks, food, and souvenirs to all their friends who called. The mounted company's booth represented a bivouac camp, with their ponies under nipa shelters. Another booth was an enormous prone papier-maché tiger, one hundred and thirty feet long. Entertainment inside. Another, just the head of a tiger, teeth, eyes, and claws, containing electric lights The lake was covered with paper lotus flowers, electric lighted, and the drives and paths were a mass of lighted lanterns and bunting hangings.

This function closed the fêtes in honor of the coronation. During the whole gala week there was a continuous succession of elaborate dinners, luncheons, and receptions by the various officials. Two dinners were given at the palace by the King, with two hundred plates at each. The service was perfect.

Bangkok is situated thirty miles up the Menam River from the coast, and is hot at all seasons, though near the 15th parallel of latitude. It is in the center of an immense "paddy" (rice) field, extending in all directions to the horizon. This great extent of paddy country accounts for the nation, as rice is their



SIAMESE ACTORS

Photo from Lea Febiger

THE TEMPLE OF WAT CHANG, ON THE BANKS OF THE MENAN RIVER, A MILE FROM BANGKOK

main source of wealth, *one million two hundred thousand tons* being the annual average crop, of which they export about one-half. The teak-wood industry from the forests in the north also add greatly to the country's wealth.

Bangkok is not unlike our own Manila, with the ancient city surrounded by a wall, only much of the wall has been demolished to make way for modern improvements. The inner wall around the palace grounds is, however, still intact. The crenellations on the top of the wall, instead of being the conventional square pattern, are shaped like the ace of spades.

The city is full of "klongs," or esteros, in former times the only mode of communication between sections, though now there are over one hundred miles of wide macadamized streets, constructed within the last ten years, where automobiles are much in evidence. I was told that the King has fifty-four for his own use and his entourage.

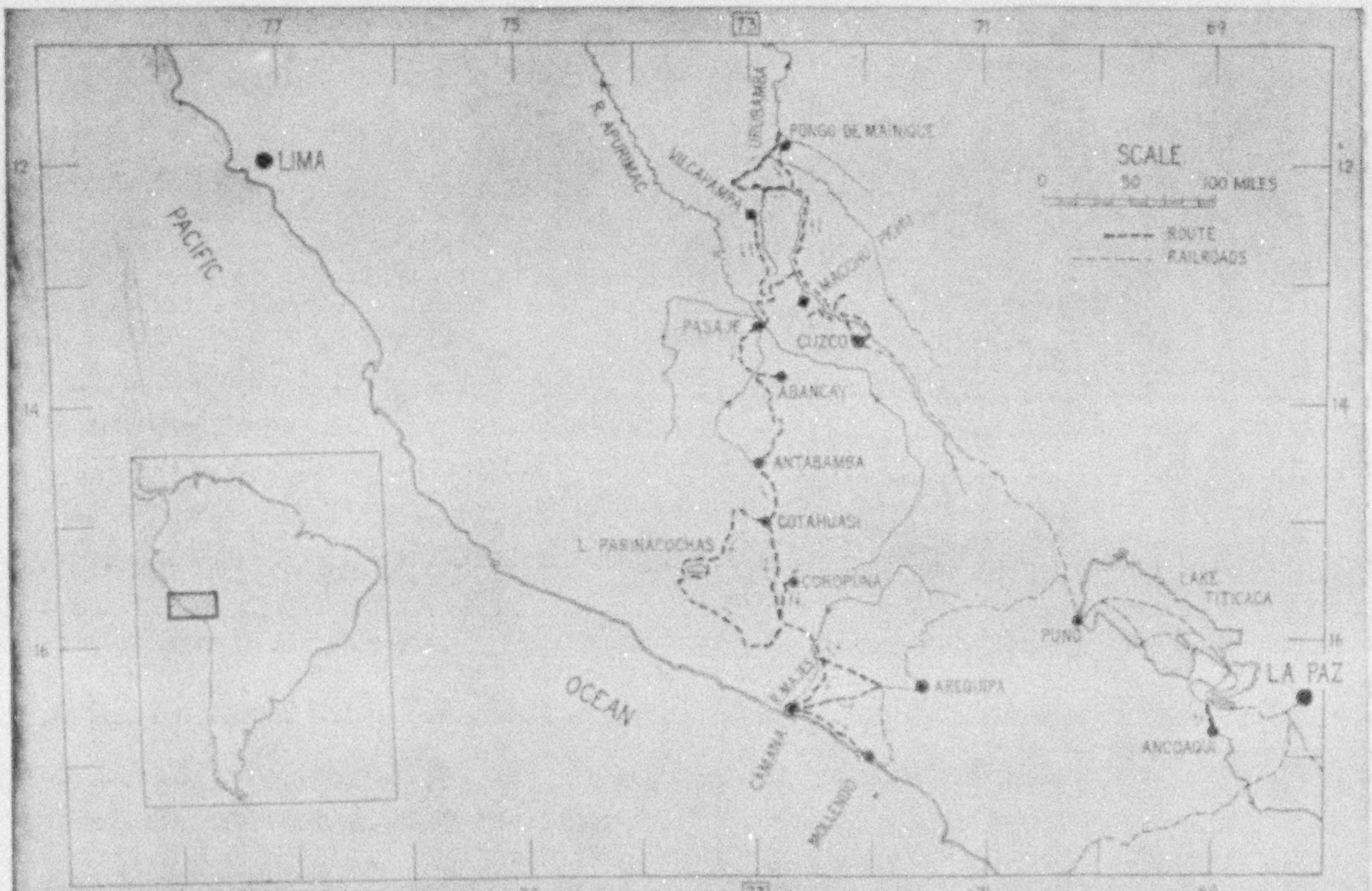
"Wats," or temples, take the place of convents and churches, and "prachidees" the place of spires. The "prachidee" is used almost as a national crest. The royal crown is designed from it, it is a part of the coat of arms, and is used like our eagle on their uniform ornaments. The erection of one near some temple is the favorite way of "acquiring merit," so dear to the Buddhistic heart.

Men and women both, in all walks of life, wear the "panung," a piece of silk or cotton cloth about three yards long and one broad, which is wound round the hips, the slack then rolled up and passed between the legs and hitched up behind. It gives the appearance of a pair of loose knickerbockers. The men wear a white or colored coat of European cut, and the women a jacket or blouse.

Though Siam is "The Land of the White Elephant," that animal was not at all in evidence in the various parades, though he is quite numerous in the upper or hill country, where he is used as a beast of burden. The only elephants in Bangkok were the five sacred white ones stabled inside the palace grounds, and they were not white—at least not to the casual observer—though when attention was called to it they had a sort of moth-eaten appearance around the head and ears, which was a lighter gray than the body, and they were reported to have some white hairs on back and tail. But they are not amiable, so were not closely inspected by me.

Practically all the royal family and many of the upper class are educated in Europe. All speak English perfectly, and many in addition French, German, and Russian.

A more courteous or charming people I have seldom met. Never having been a subject race, they have not that perceptible cringe observed in some Oriental people where the white man has been, or is, the dominant power. Their native name, "Thai," signifies "the free."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OUTLINE MAP SHOWING FIELD OF WORK OF THE PERUVIAN EXPEDITION OF 1912, UNDER THE AUSPICES OF YALE UNIVERSITY AND THE NATIONAL GEOGRAPHIC SOCIETY (SEE PAGES 417-422)

EXPLORATIONS IN PERU

THE National Geographic Society has subscribed $10,000 to the Peruvian expedition of 1912, to which the friends of Yale University have made an equal grant. The expedition is directed by Dr. Hiram Bingham, of Yale University, who was also director of the remarkably successful Yale Peruvian expedition of 1911, and will be known as "The Peruvian Expedition of 1912, under the Auspices of Yale University and the National Geographic Society." The researches and explorations of last year will be continued, the work centering in the Vilcabamba Valley and around Cuzco.

This region was the cradle of the Inca race, which became an empire 2,000 miles long, and reached a very high degree of civilization and culture. Comparatively little is known of its origin or of the wonderful Megalithic people who preceded them, and who built vast palaces and temples, which have endured to this day (see page 421).

In addition to the discovery of eight Inca and pre-Inca cities and temples, Professor Bingham found (1911) in a gravel bank in Cuzco the bones of the thighs, hip, ribs, and a portion of the skull of three human beings. The bones appeared to be interstratified with gravel of glacial age and may be the remains of men who lived 20,000 to 50,000 years ago. Other bones were also found, one of which appears to be the bone of a bison, the first recorded evidence of bison south of Mexico.

"The proof of the antiquity of this man," says Richard Swann Lull, Professor of Vertebrate Paleontology at Yale University, in the *Yale Review*, "lies . . . in the geological evidence offered by Professor Bingham that the remains lay at the bottom of a mass of stratified gravel, which covered them at one time to a depth of not less than 125 feet, a fact which, he rightly argues, points to glacial origin. Just what that means in the light of man's antiquity in Europe is not so clear, for it is not yet possible to correlate with any assurance a glacial deposit in South America with the measured advances and retreats of the great ice-sheet of the Old World.

"A conservative estimate of at least 20,000 years has been given as the probable age of the Cuzco man, a mere fraction of the duration of time since the appearance of *Pithecanthropus* (ape-man), or the man of Heidelberg or Neandertal; but whether the age be 20,000 or 60,000 years, if this discovery, which should be amplified by further exploration, will bear the test of time, its importance is paramount as the first authentic physical record of man's existence in the prehistoric western world."

Where did the bones come from? This question can be answered only by a careful geographical and geological study of the Cuzco basin and its vicinity, with special reference to the age of the gravel deposits where the human and other remains were found. Seldom do we find geographical and historical problems so intertwined as they are in Peru. Only a careful geographical study of the region can solve the many mysteries which are now puzzling the historian, the anthropologist, and the archeologist.

The Peruvian expedition consists of Hiram Bingham as director; Herbert E. Gregory, Silliman Professor of Geology in Yale University; Dr. George F. Eaton, Curator of Osteology in the Peabody Museum of Yale University; Albert H. Bumstead, for seven years topographic engineer in the United States Geological Survey; three assistant topographers, a surgeon, and three general assistants. A topographic map on the scale of two miles to the inch, with a contour interval of 100 feet, of the Cuzco basin, and also a detailed map of the entire Vilcabamba country, will be immediately made.

Dr. Bingham will continue the work, so successfully inaugurated in 1911, to discover and identify the places mentioned in the Spanish chronicles and in the early accounts of Peru, particularly the places connected with the 35 years of Inca rule after the advent of Pizarro. As many of these place names have changed, it will be necessary to identify the places by a careful comparison of their situation and surroundings with the itineraries and descriptions given in the chronicles. An attempt will be made to penetrate still further into the jungles of

XUM

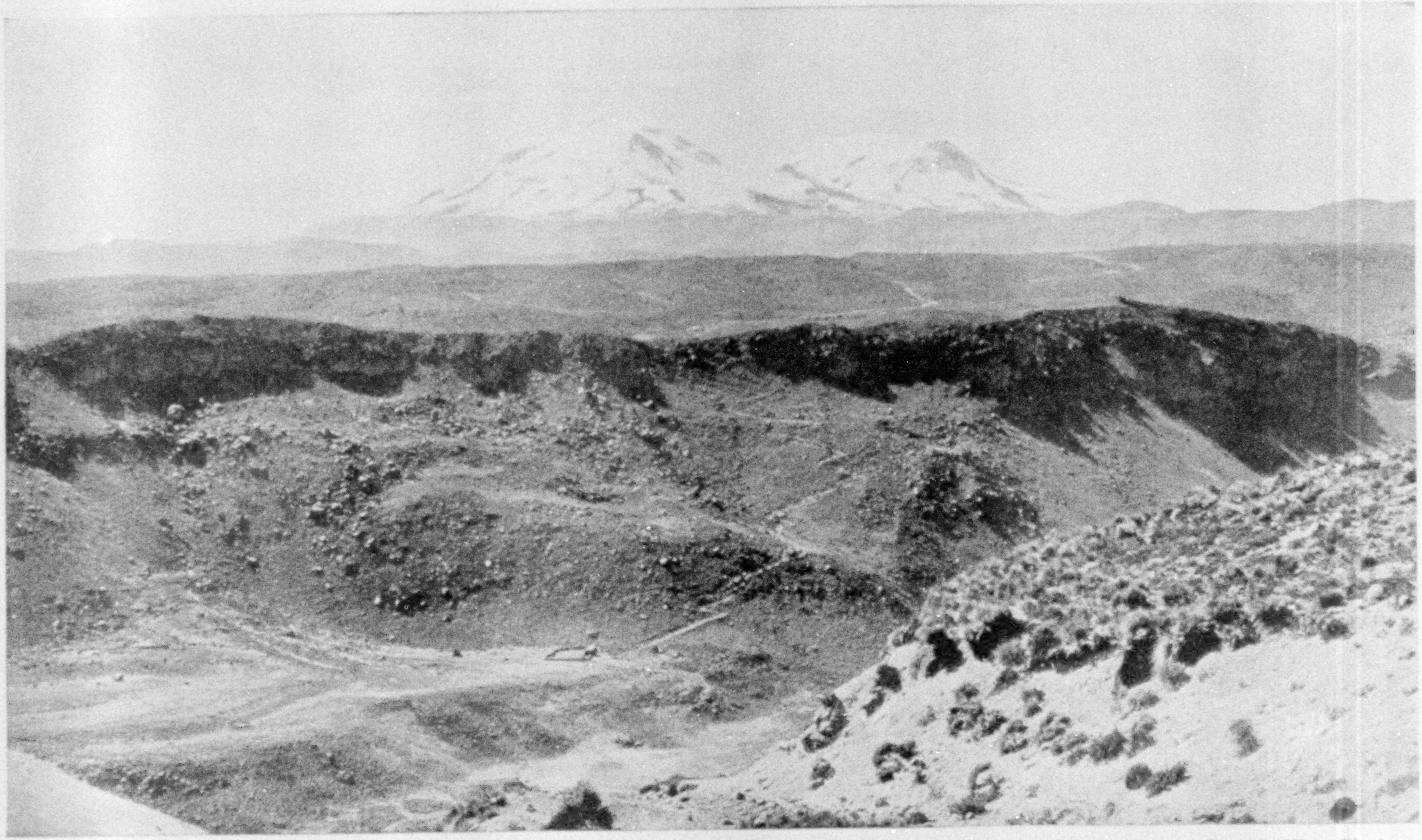


Photo by Hiram Bingham

ONE OF THE MANY SUPERB MOUNTAINS OF PERU: MOUNT COROPUNA AS SEEN FROM THE HEIGHTS ABOVE ARMA, SHOWING ROAD DESCENDING TO ARMA

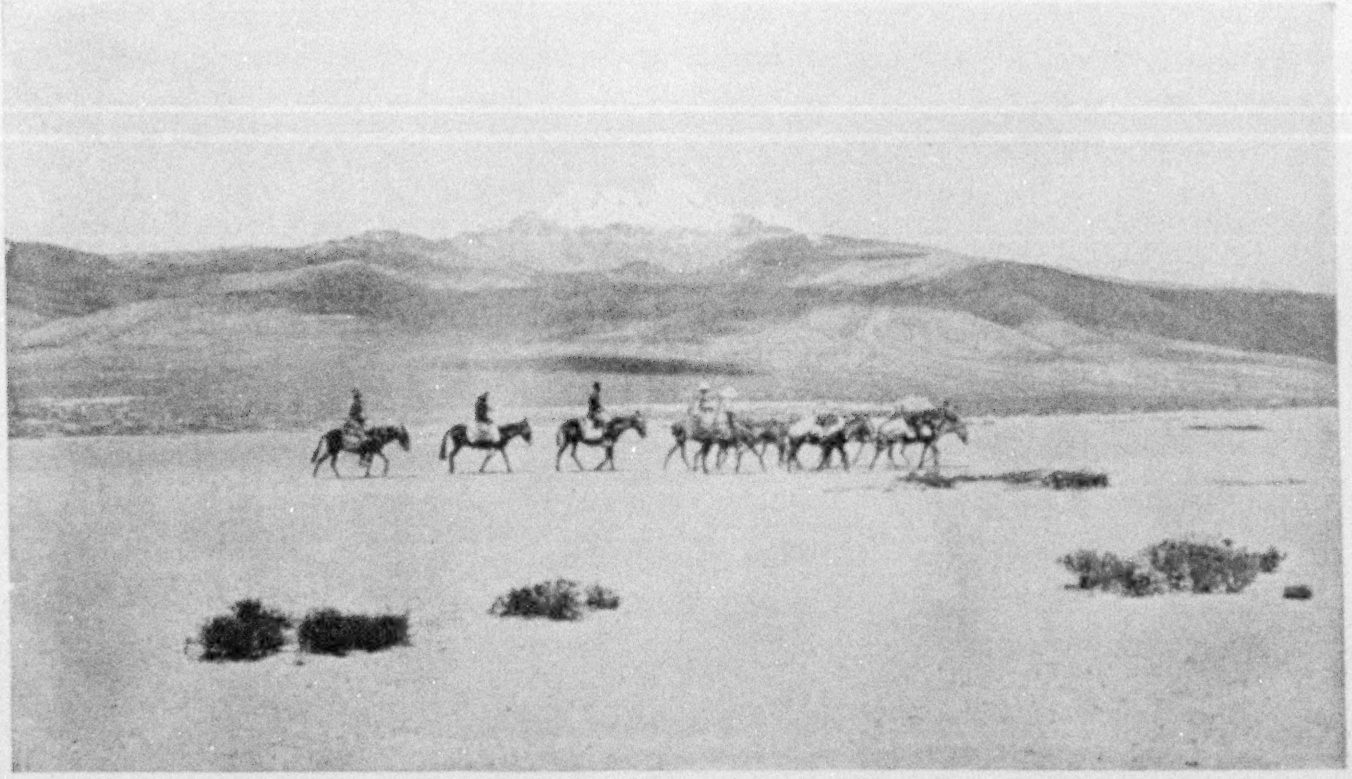


Photo from Hiram Bingham

ANOTHER VIEW OF COROPUNA

The mountain was ascended by Hiram Bingham in 1911. A careful survey and triangulation of the mountain from its vicinity to the seacoast by the Yale expedition showed that its real height is 21,703 feet—1,000 feet less than had been previously credited to it.

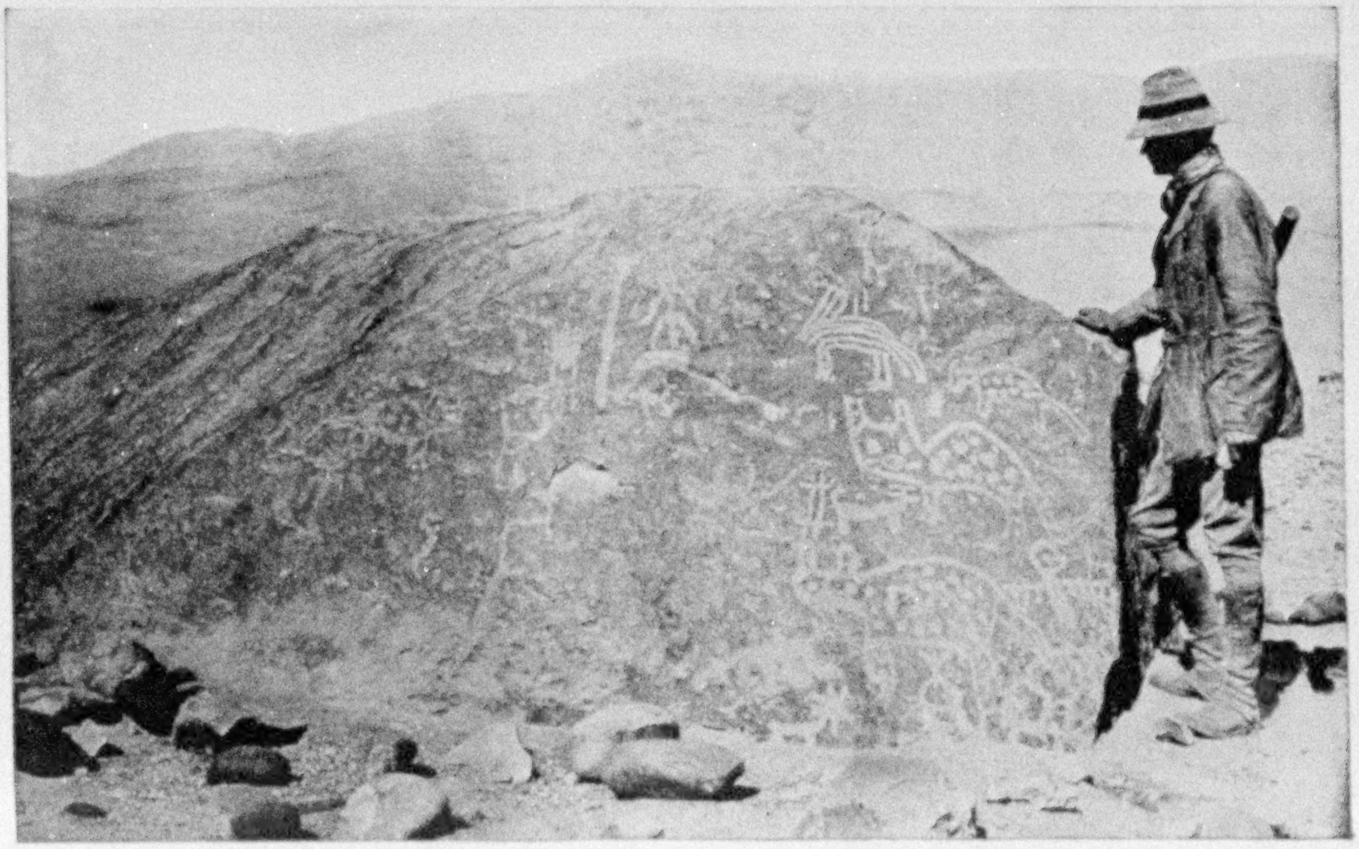


Photo from Hiram Bingham

A VOLCANIC BOULDER COVERED WITH PICTOGRAPHS IN THE VALLEY OF THE MAJES: PERU

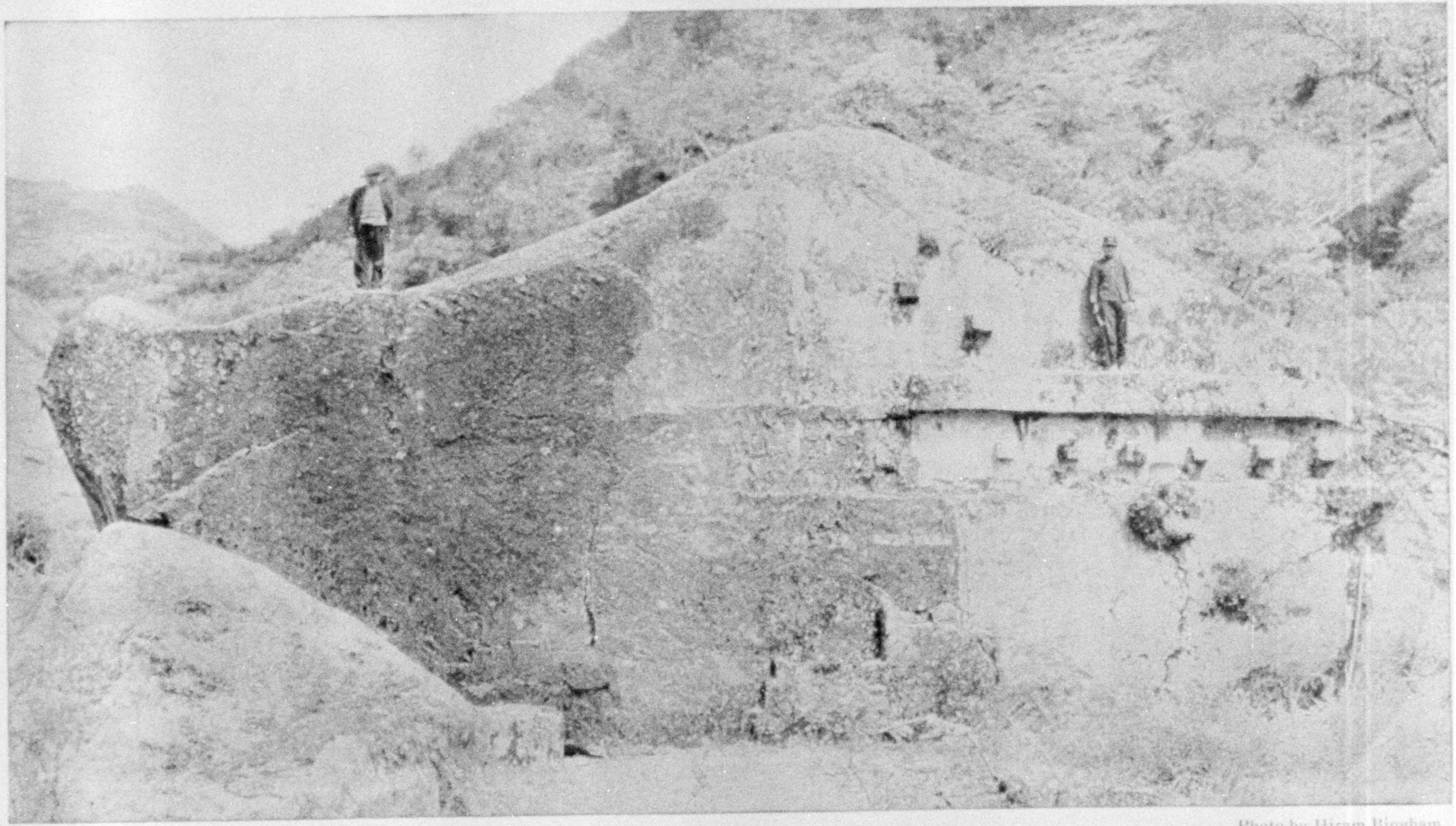
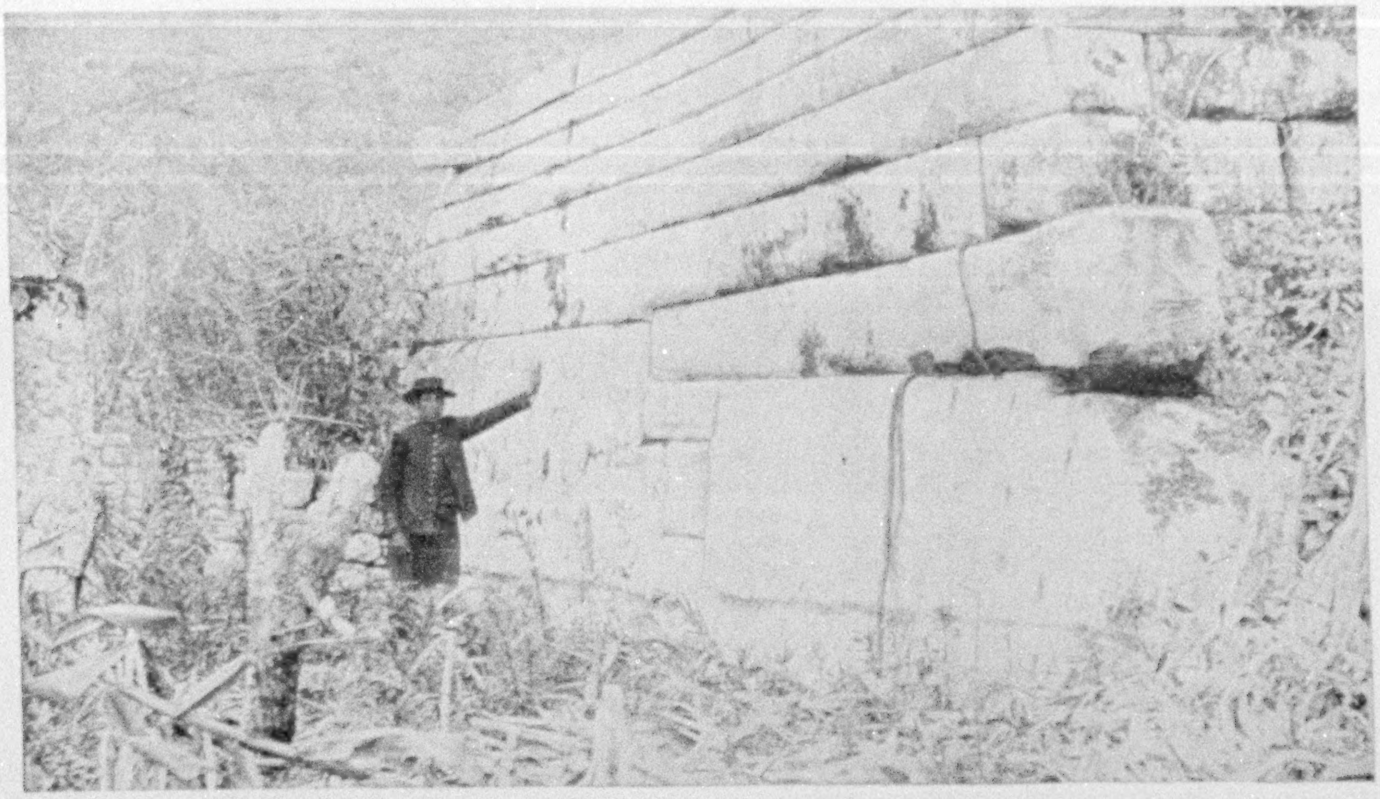
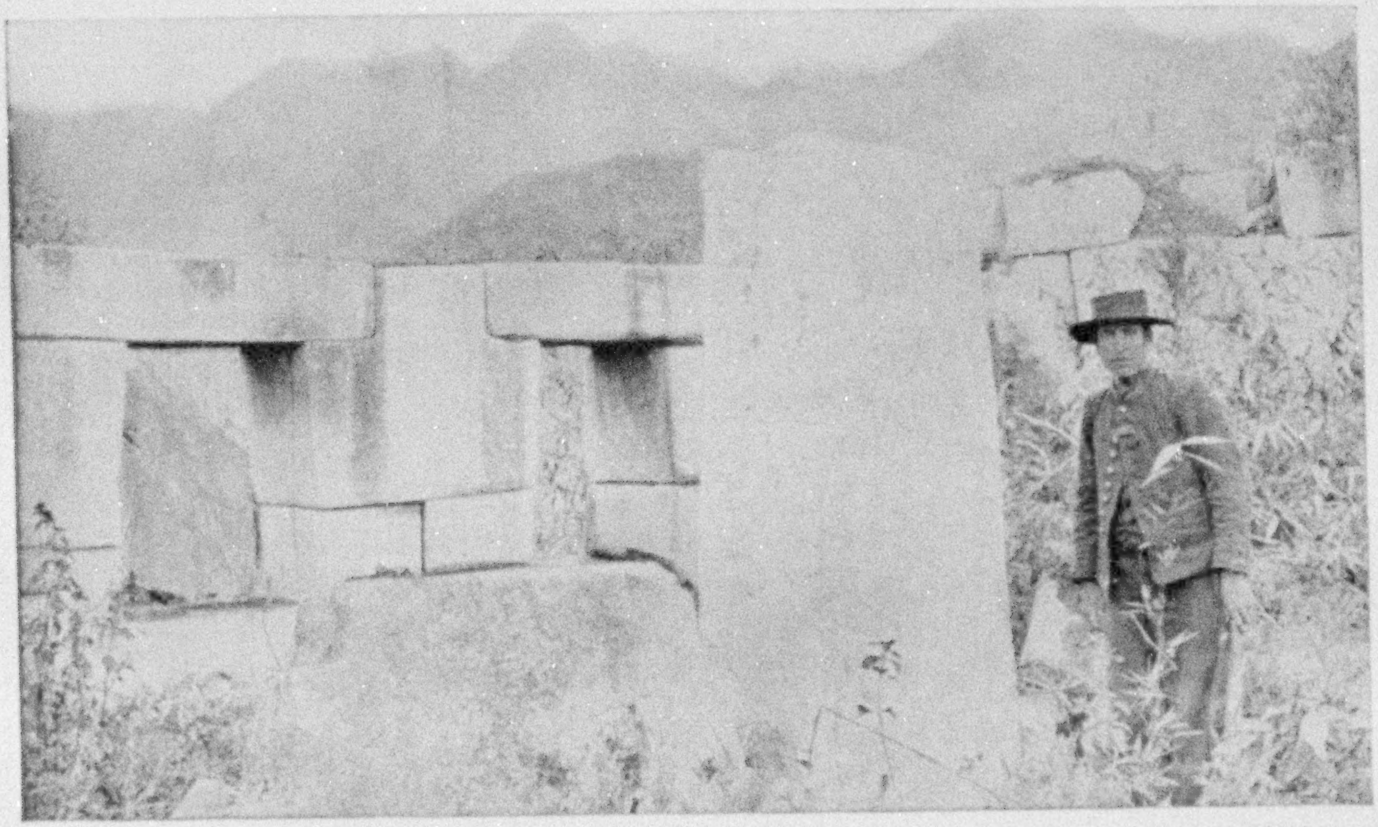


Photo by Hiram Bingham

THE GREAT CARVED MONOLITH OF YURAKRUMIU

The temple here was the center of the Inca religious cult after the capture of Cuzco by the Spaniards. The site of the town and the monolith were discovered by Hiram Bingham on his Peruvian expedition of 1911





Photos by Hiram Bingham

THE RUINS OF MACCHU PICHU, A CITY PROBABLY BUILT BY THE MEGALITHIC RACE, WHO PRECEDED THE INCAS: DISCOVERED BY HIRAM BINGHAM ON HIS 1911 EXPEDITION TO PERU

The ruins are on an almost inaccessible ridge, 2,000 feet above the Urubamba River. They are of great beauty and magnificence and include palaces, baths, temples, and about 150 houses. The huge blocks of white granite, some of them 12 feet long, were so carefully cut that they match perfectly. Though no mortar or cement was used to hold the stones together, the walls have withstood the elements for at least 2,000 years. The stone against which the man in the upper cut is leaning is 13.2 feet in length and about 2.8 feet in thickness.

A VIEW OF THE INTERIOR OF THE TEMPLE OF THE THREE WINDOWS, LOOKING NORTH: MACCHU PICHU

The monolith is grooved at its top, evidently to support a wooden rafter

XUM

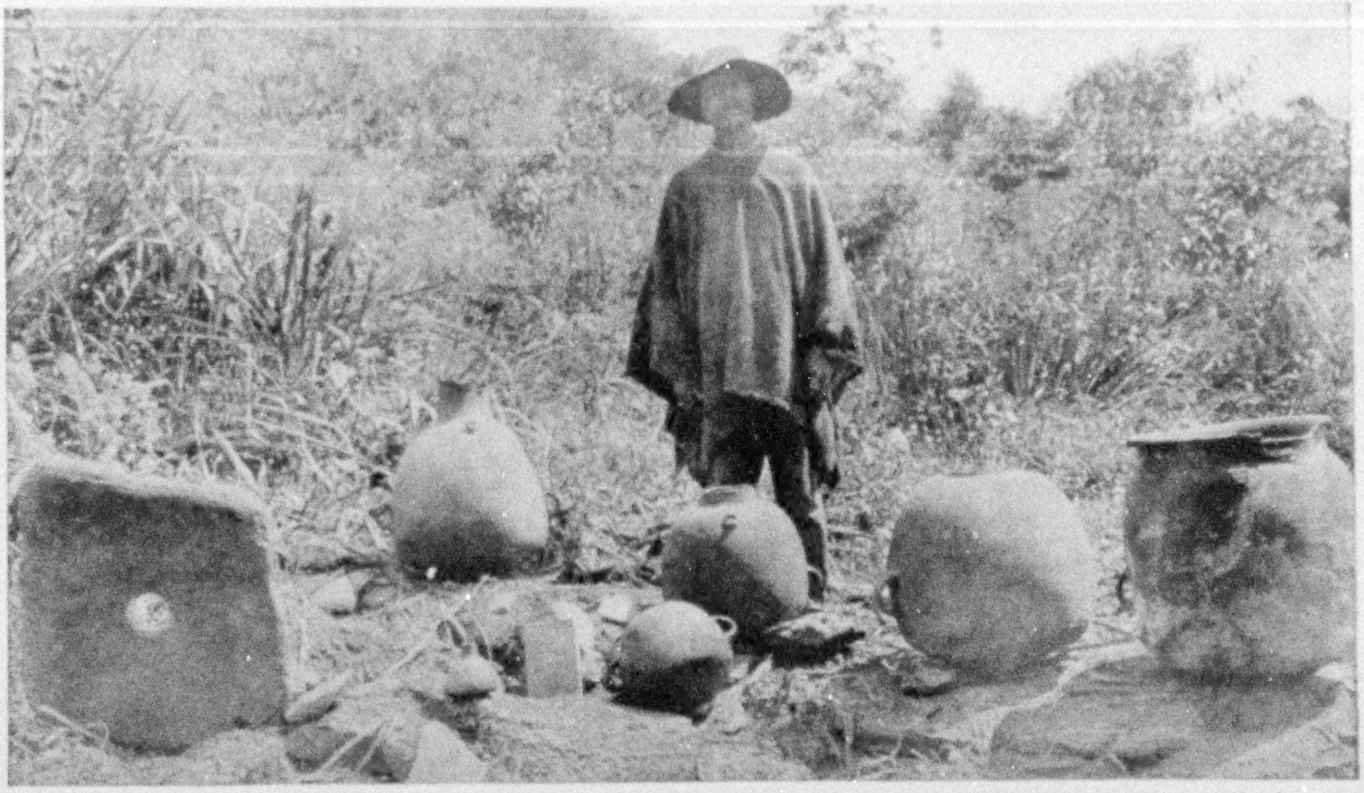


Photo by Hiram Bingham

INCA POTTERY AND STONEWARE RESCUED FROM THE JUNGLE AND NOW USED IN THE MANUFACTURE OF SUGAR

The notebook was put in the picture to give the pots a sense of proportion. It measures 4¾ inches in width and 7⅝ inches in length. The stone on the left with a round hole in the middle was found covering a grave, bottle shaped and lined with stone, in which nothing else of importance was discovered.

the Pampaconas Valley and beyond, to see whether any more remains of Inca occupation can be found.

Mr. Bingham has made a specialty of South American researches. In 1906 he explored the route of the great General Bolivar, in his famous campaign of 1818, from the heart of the llanos of Venezuela across the plains and the Andes into the heart of Colombia. A four months' journey on muleback carried the party from Valencia, in northern Venezuela, across Venezuela and Colombia to Bogotá. The return trip was made by way of the Magdalena River. The journal of this expedition has been published by the Yale University Press under the title "*The Journal of an Expedition across Venezuela and Colombia.*"

In 1908 Professor Bingham made an overland journey from Buenos Aires to Lima, following the route of the Spanish traders in the colonial period. The account of this expedition was published by Houghton-Mifflin Company under the title "*Across South America: An Account of a Journey from Buenos Aires to Lima by way of Potosí, with Notes on Brazil, Argentina, Bolivia, Chile, and Peru.*" The chief interest of this trip lay in its being an exploration of the most historic highway of South America. The more difficult parts of the road had been used by the Incas and their conqueror Pizarro; by Spanish viceroys, mine owners, and merchants; by the liberating armies of Argentina; and finally by Bolivar and Sucre, who marched and countermarched over it in the last campaigns of the wars of independence. Information was collected regarding the South American people, their history, politics, economics, and physical environment.

On this journey, at the invitation of the Peruvian government, Professor Bingham explored the ruins of Choqquequirau, an Inca fortress in the valley of the Apurimac. His study of these ruins in a region hitherto unexplored led him to desire to penetrate still further into this country, which is one of the most inaccessible in the Cordillera.

Vilcabamba was chosen by the last Incas as the safest place in which to rule without being disturbed by the Spaniards, who had conquered the larger part of Peru. This almost inaccessible labyrinth of grand canyons, tropical jungles, and glacier-clad mountains is the scene of his present work.

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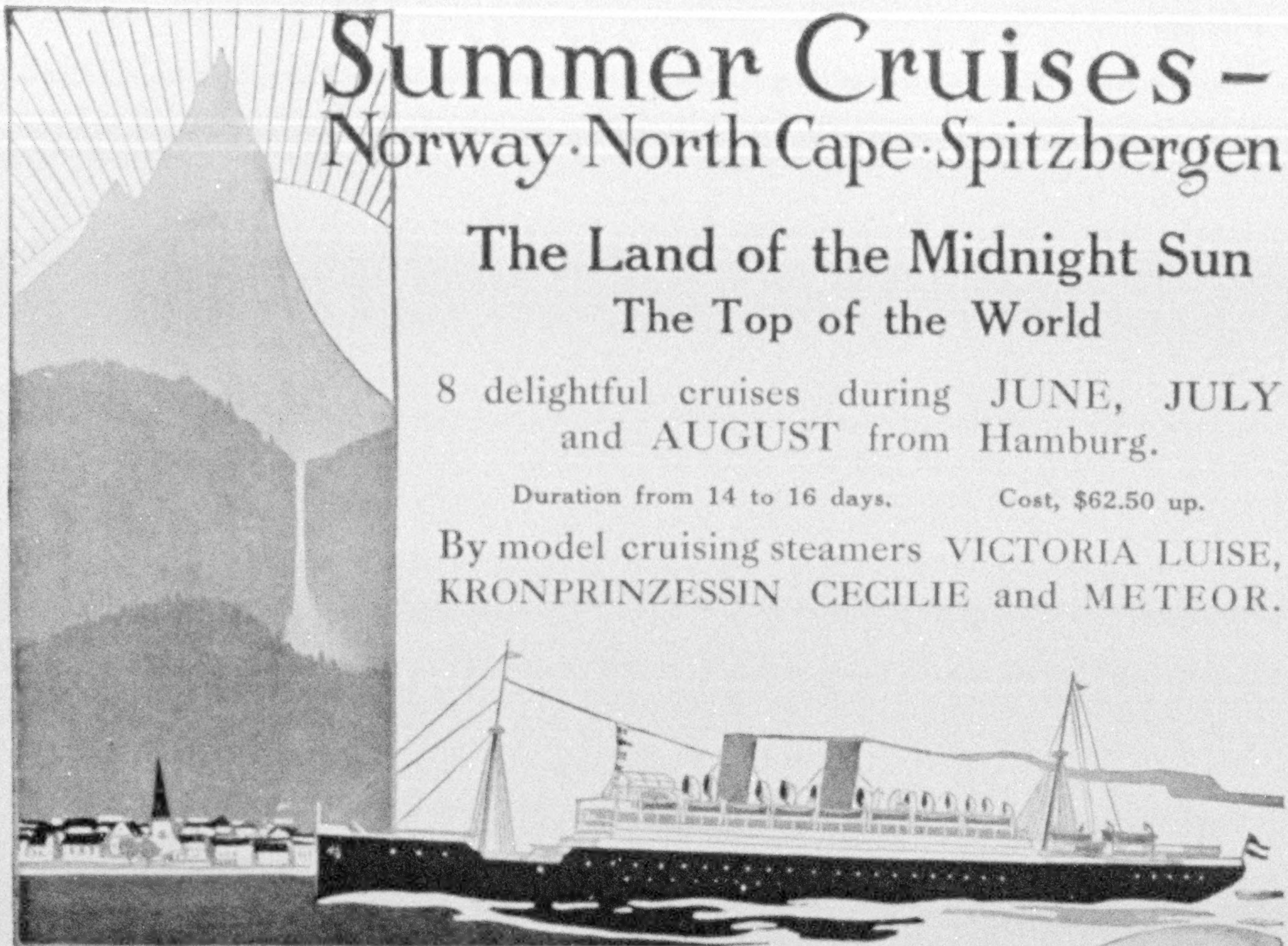

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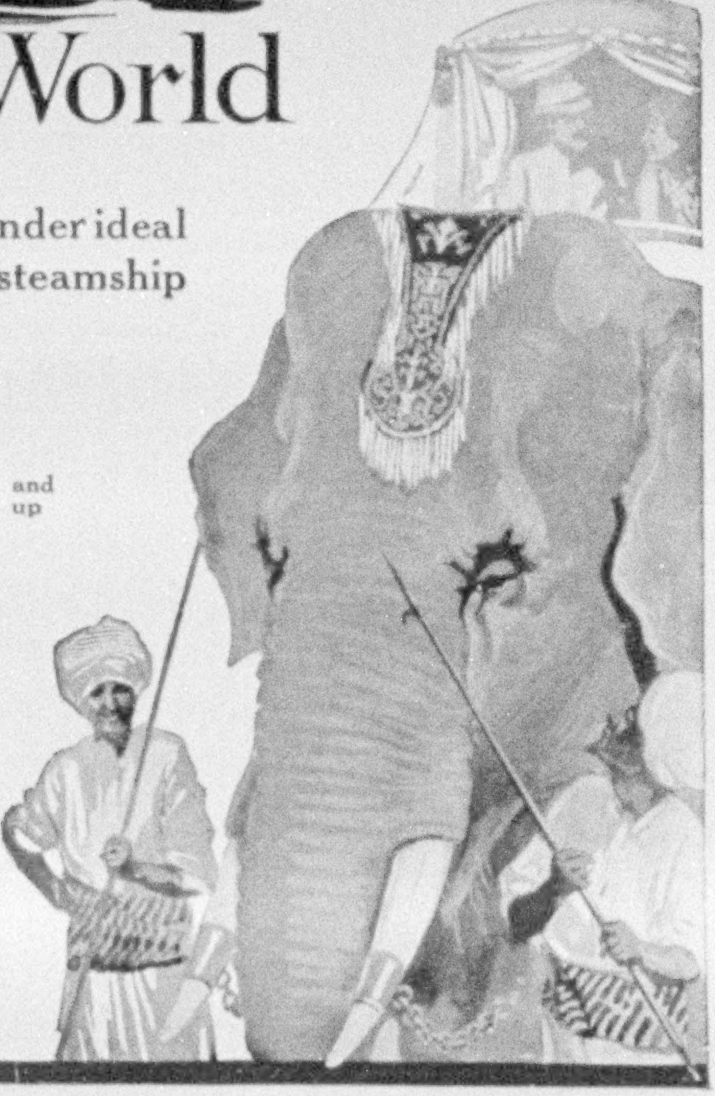

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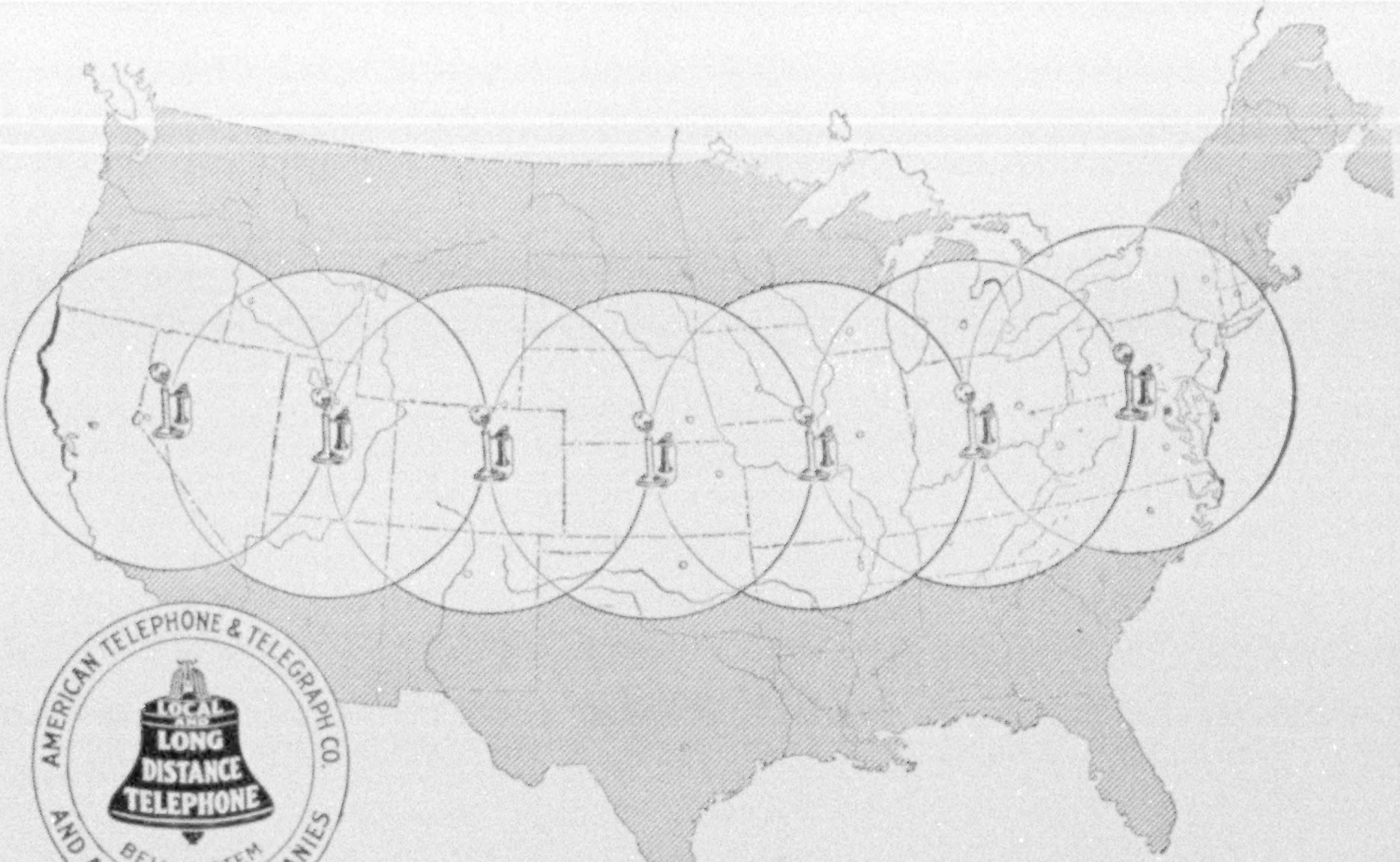

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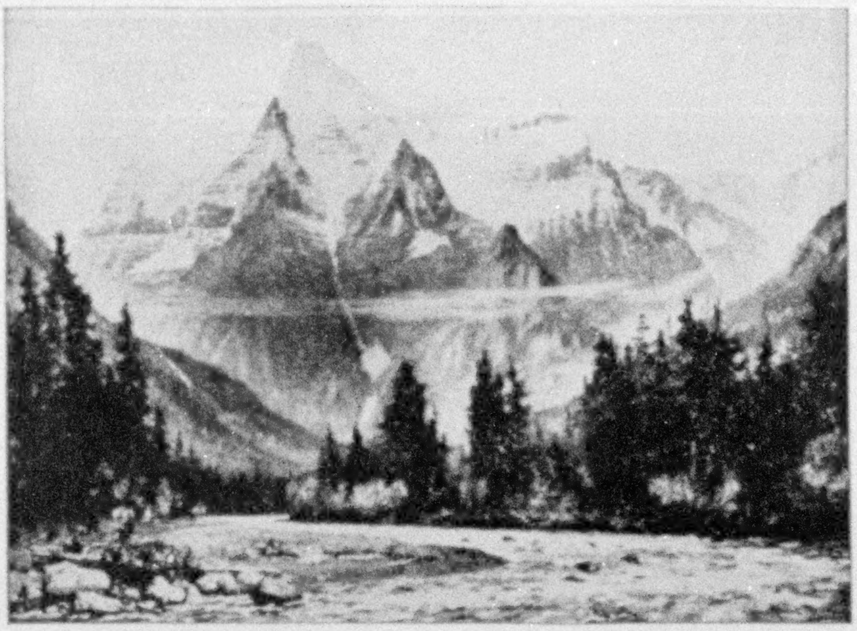

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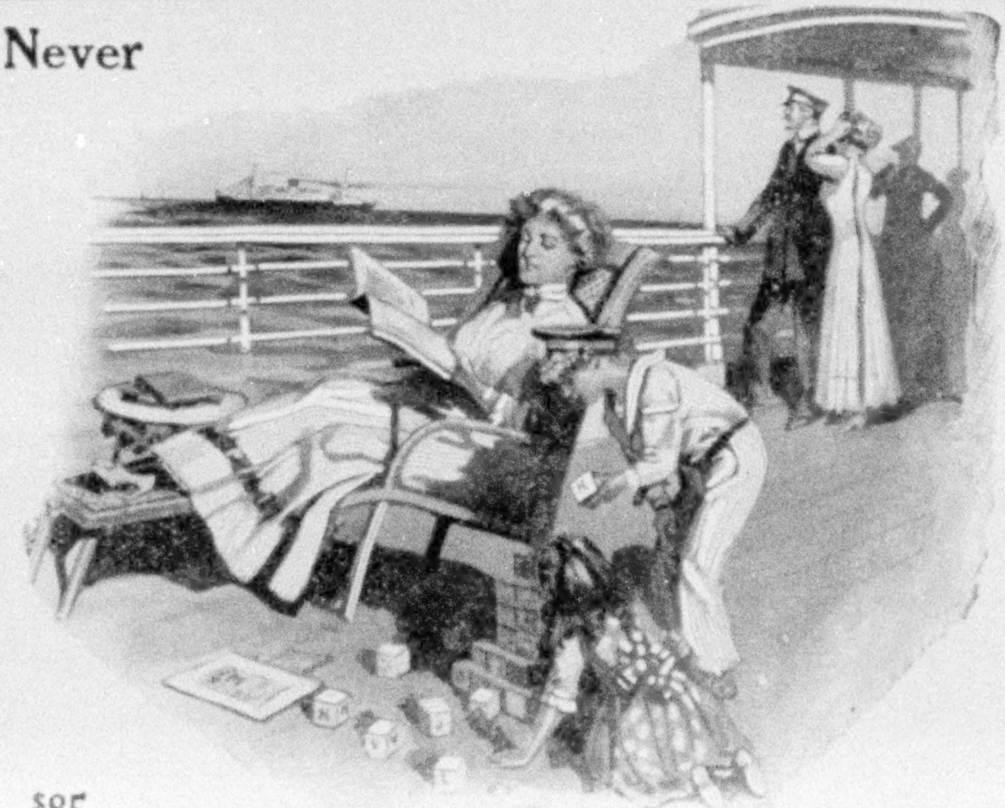

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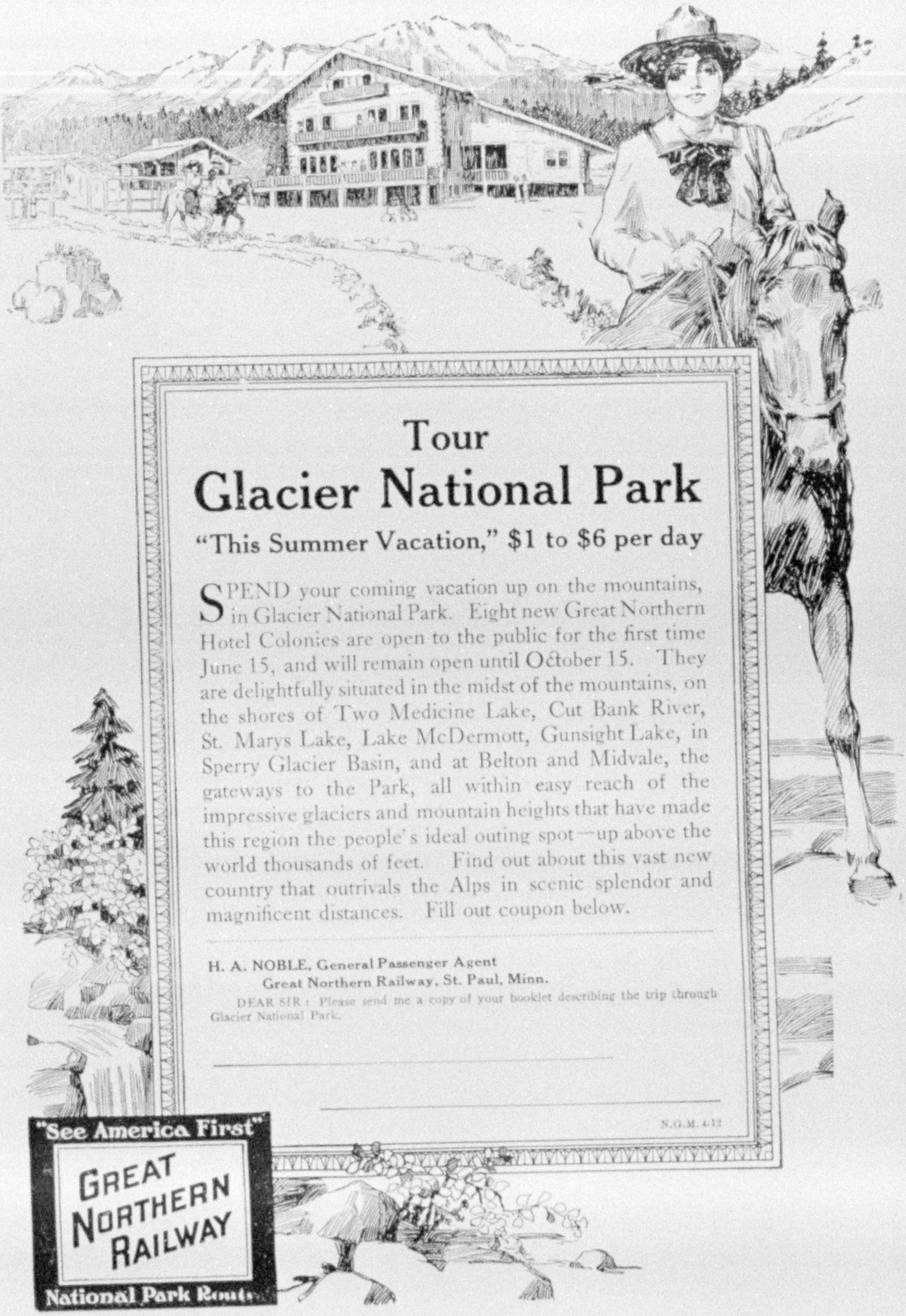

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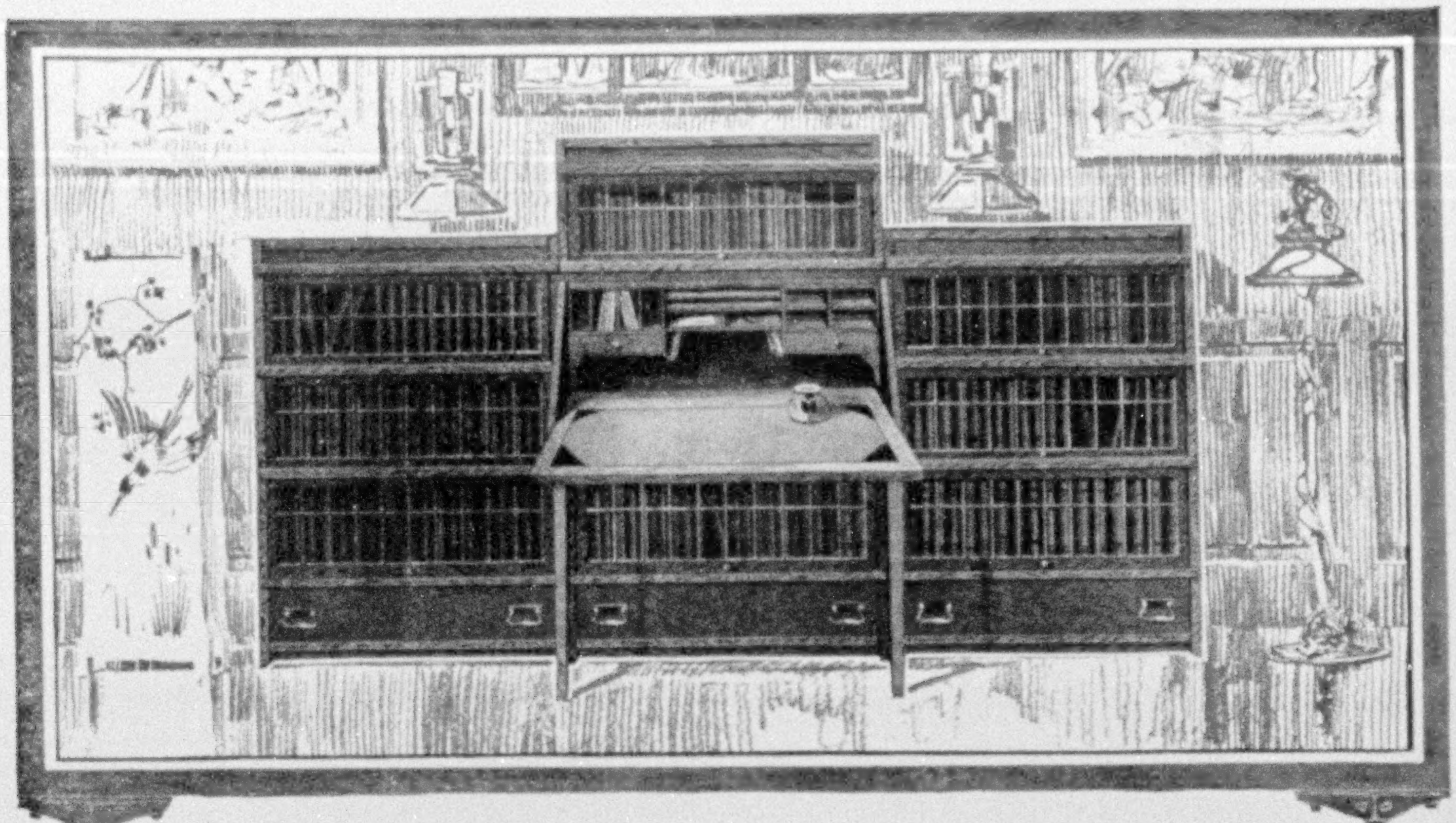

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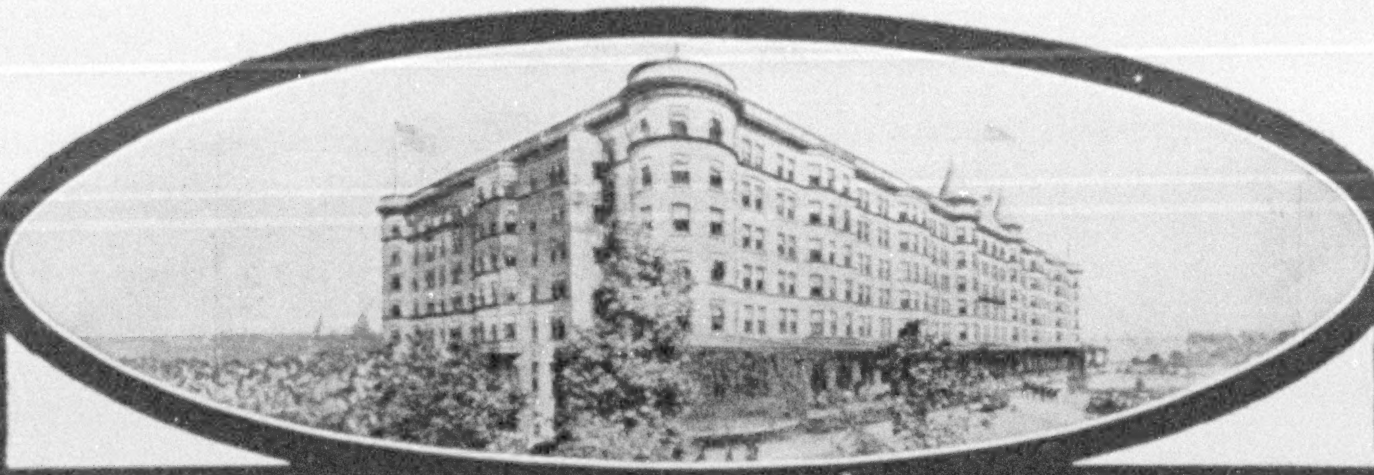

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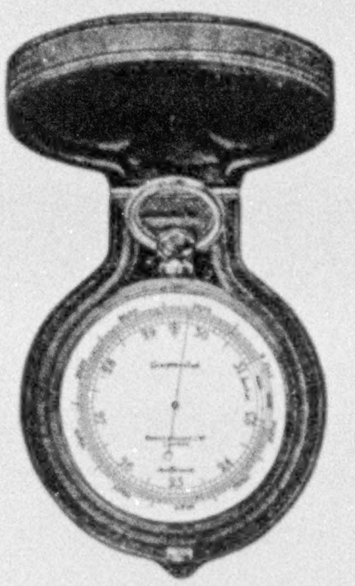

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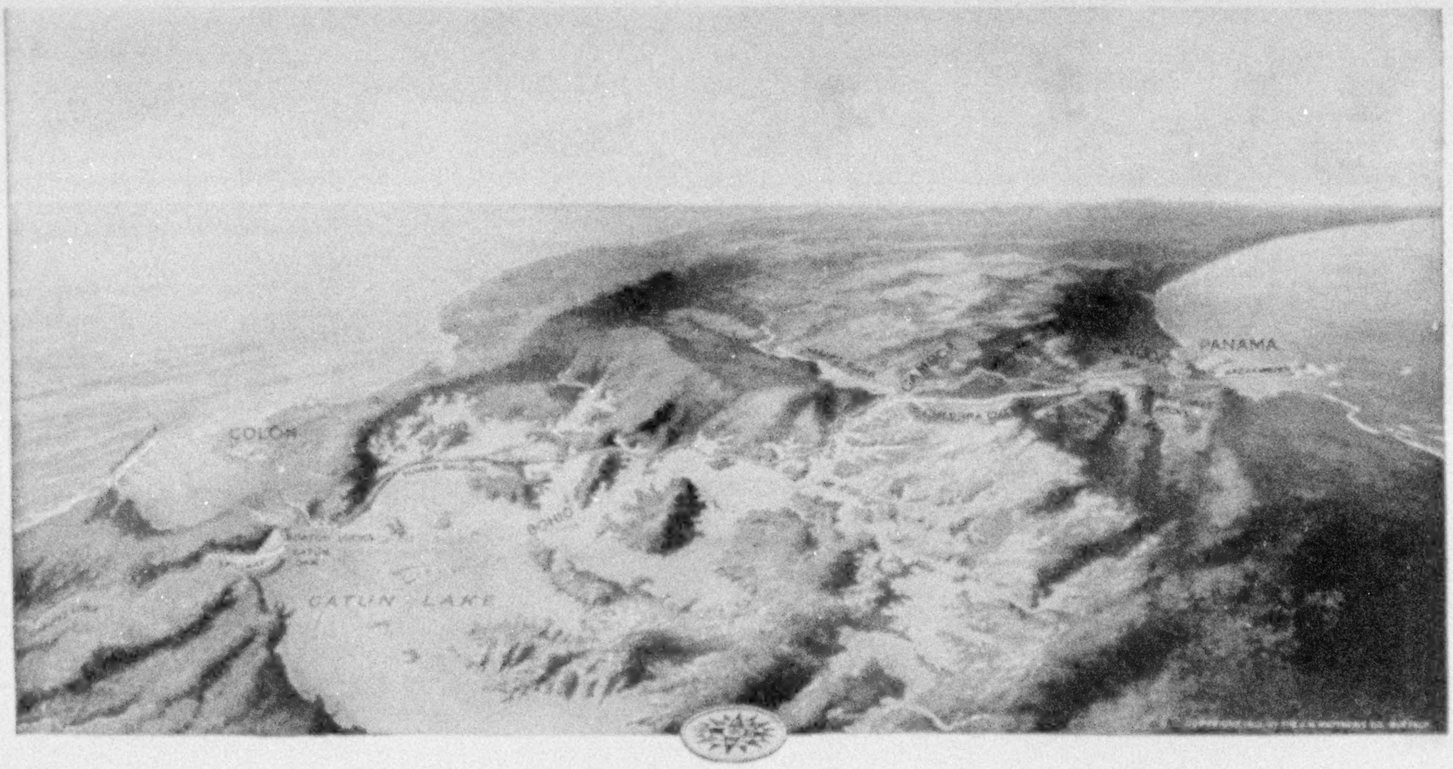

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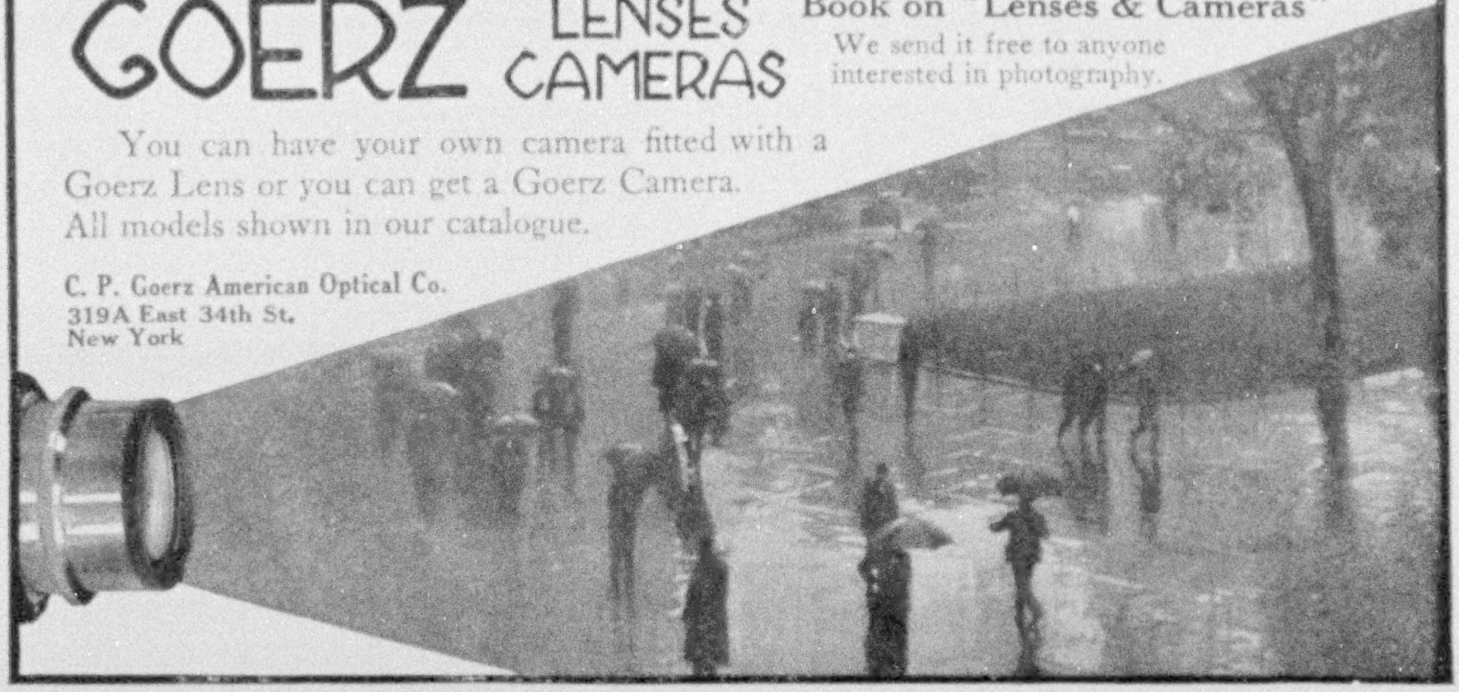

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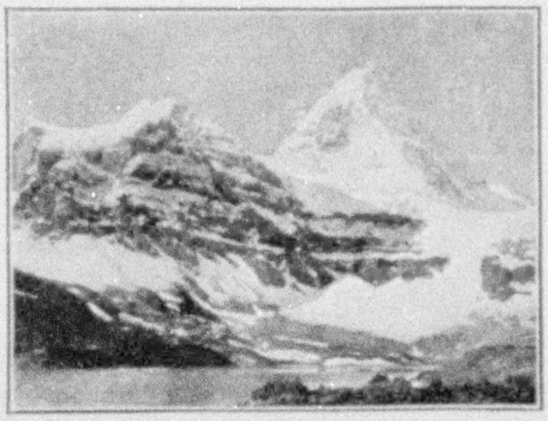

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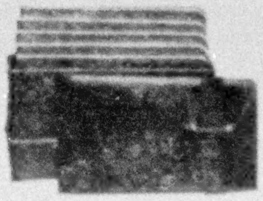

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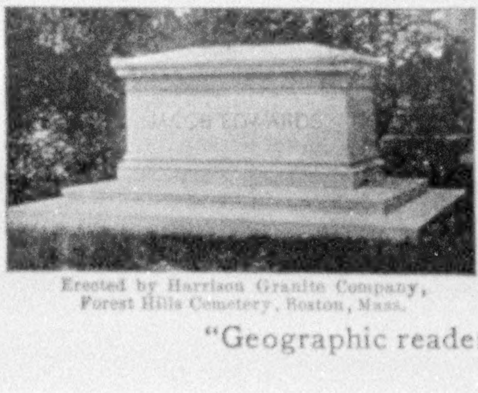

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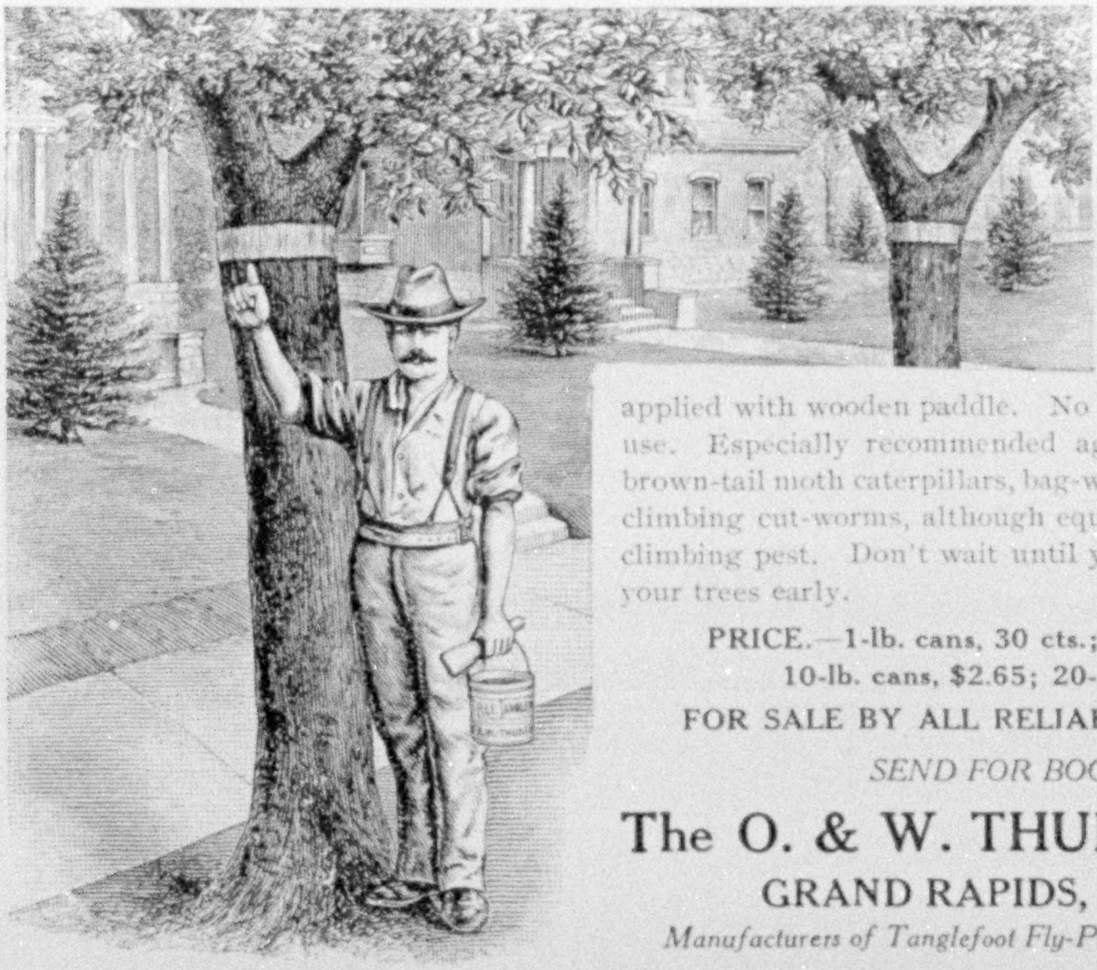

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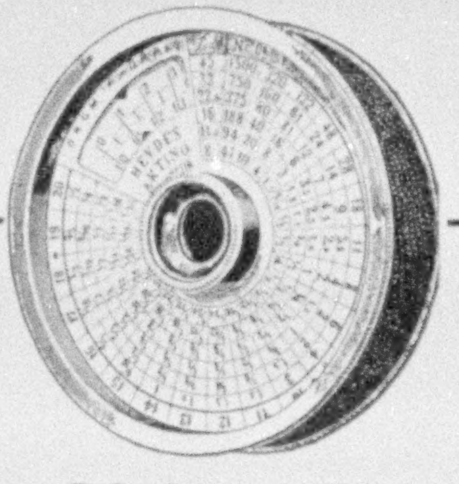

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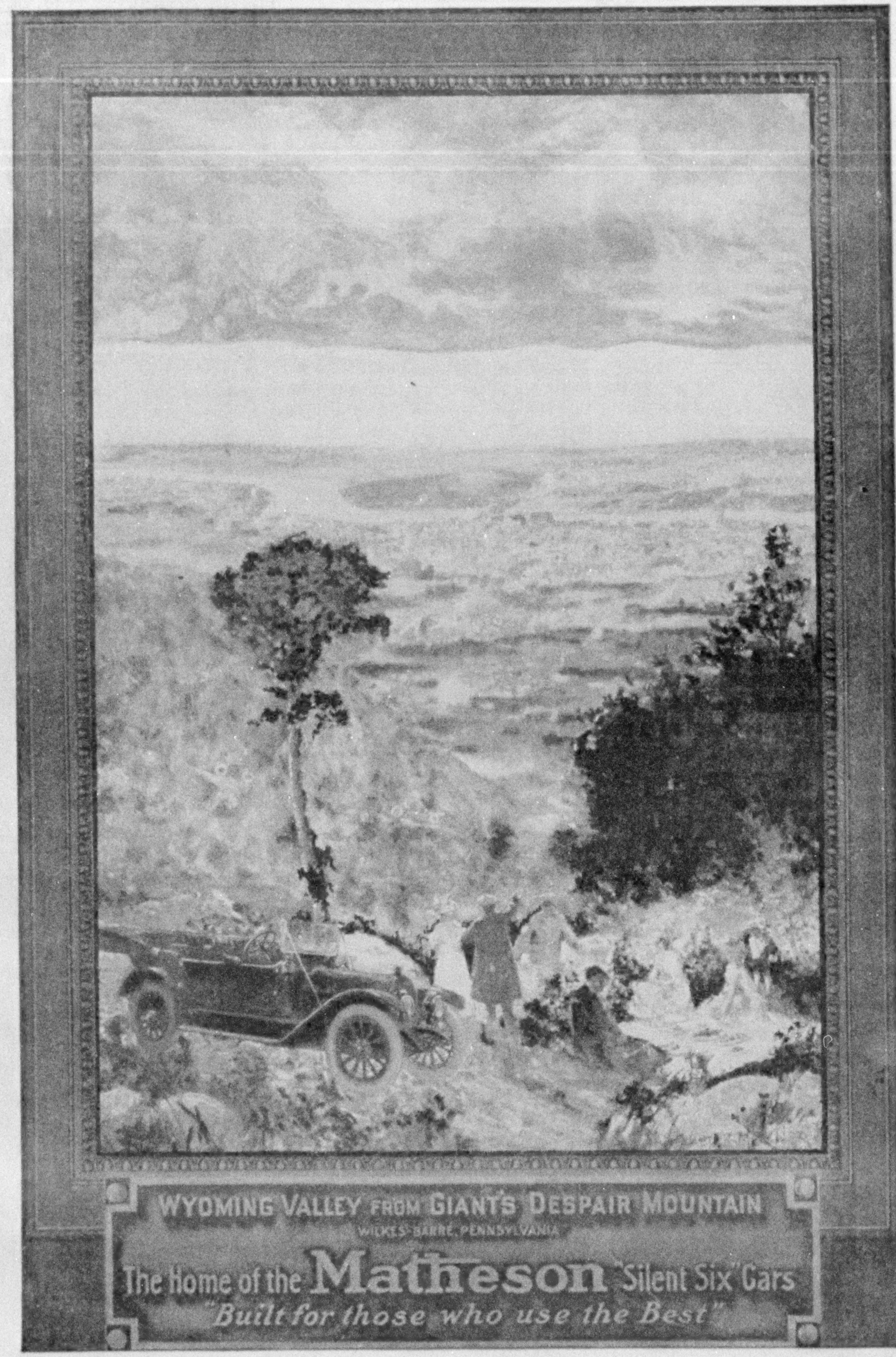
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